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CAR AND DRIVER

MAR/2017

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TESTING AUTOMAKER APPS
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Backfires:
The joyful noise of the commentariat, rebutted sporadically by Ed.

DOWN TO THE 'MARO

Am I the only person who noticed the poorly Photoshopped image of the underside of the new 2017 Chevy Camaro ZL1 ["Ballistic Leaf Blower," December 2016]? The lift arm on the left side of the picture is completely disconnected. The pics are shot from different angles and don't line up.

—Jeff Schleede
Spencerport, NY

The picture of the ZL1 up on the lift, on page 047, looks a bit weird. The left-rear swing arm appears to be, well, you look at it.

—Jerry Allen
Charlotte, NC

We couldn't get the whole ZL1 underside in one shot without distorting the details, so we did it in three and tried to make the splits obvious. It worked!—Ed.

I'm a huge Chevy fan (own two Camaros currently), and the last time I was moved to write was the prior ZL1 test. Back then, I was upset that the car was overweight and underpowered. Now, I'm just confused.

The ZL1 used to be the straight-line powerhouse, and the Z/28 was the corner carver. This new car seems to be a blend of both. As such, it lacks focus and fails to excel in either realm. It probably won't beat a Ford Mustang Shelby GT350 around a track, and it probably won't beat a Dodge Hellcat in a drag race.

Nice work, Chevy. You wrecked your own branding strategy and left us all wondering, ZL-WTF?

—Brian Bark
Newtown, PA

MONEY PROBLEMS

Unless you guys are overpaid, you can't afford any of the elite cars you so love to test. Neither can I. I'm sorry, but there is just nothing relevant to read anymore in your book.

—Wayne Burkart
The Villages, FL

"THE ZL1 USED TO BE THE STRAIGHT-LINE POWERHOUSE, AND THE Z/28 WAS THE CORNER CARVER. THIS NEW CAR SEEMS TO BE A BLEND OF BOTH. AS SUCH, IT LACKS FOCUS."

◄

It seems as if readers are always complaining that you cover cars that are too expensive for the common man. I'm sure I'll fall into this class later in life, but, as a young bachelor, my subscription has proven to be the best birth control a man can buy!

—Jackson Savoy
Fredericksburg, VA

WATER FOR ELEPHANTS

The Bugatti Chiron ["On a Highway in Hell," December 2016] looks as if a Camaro is eating it.

—Jack Williams
Sultan of Swim

STEER CLEAR

Four-wheel steering is nothing new ["Ringing the Bull," December 2016]. I remember reading about it way back in the '80s. All four-wheel-steering systems do essentially the same thing: countersteer at low speeds and in-phase at higher speeds. Heck, even GM pickup trucks could do that not too long ago. Give any old technology a whiz-bang new name, and people will think that you've created a revolutionary new product. Sorry, not impressed. Lambo hasn't done anything groundbreaking here.

—Michael M. Melton
Las Cruces, NM

No one said it was groundbreaking, and we've written about it for decades. It is, however, new to Lamborghini—Ed.

RAGS TO RICHES

As a longtime subscriber, I found your Mercedes-AMG S63 versus Bentley Continental GT V-8 S

comparo to be disappointing ["Yacht Rock," December 2016]. Giving the S-class an exterior-styling score of 6 is really a head scratcher. A 6? For the same car you listed in the 10 most beautiful cars online? When you tested the S63 coupe, you said it was "over the top in every way imaginable." And get this: You've even said, "It's virtually impossible to find fault with the S coupe's design." Doesn't sound like a 6 out of 10 to me. And not only did you give this ridiculous score, but because of it, the S-class lost. If that category had even been tied, the S-class would've won.

—Jacob Bryant
Fairfax, CA

Removing the top takes a lot away from the S-class coupe's handsome silhouette; it begins to look like a stretched-out C-class cabriolet. And if you don't like that, you really won't like that Robinson kept calling it the Toyota Camry Solara convertible—Ed.

Your recent articles on Mercedes are stupid. They constantly smart-mouth expensive cars and expensive-car buyers. I drive enough to need a safer, more expensive car. Mercedes has a "Guard" car that I may need. But your reviewers constantly smart-mouth the high-end car buyer. What fools your writers are not to see the value in these cars. You have no credibility.

—Dave
In the USA

This sounds like a vote for more expensive cars—Ed.

NO SUBSTITUTE

The other no-cost options you forgot in the Porsche Boxster S review ["Skinny Legs and All," December 2016] are the seatbelts and the license-plate screws.

—Jean-Charles Plante
Trois-Rivières, QC

BEAT THIS

I wanted to write and say how much I enjoyed "The Battle of the Off-Road Beaters" [December 2016]. The article already has me poring over Craigslist posts, trying to find an old Geo Tracker. I am the owner of a 2016 Jeep Wrangler Willys Wheeler who uses the vehicle for its intended purpose. It makes me wonder how a vehicle like mine would have stacked up. Perhaps the next time you attempt such a challenge, you should include a new vehicle for "benchmark" purposes.

—Kelby
Internet Land

Make Beard an offer. Interesting trades considered—Ed.

A little over four years ago, I was paroled from a 15-year stint with Jaguar Land Rover, first as a dealership technician, then working on the technical helpline for its North American operation. With therapy I will eventually be able to fit into society, but the experience allows me to make an observation: I doubt your Discovery's ticking noise is a pushrod.

There are three likely sources of the noise, listed in order of increasing cost and aggravation:

1. The pushrod cups in one or more of the rocker arms are loose. Most manufacturers work continuously to improve the

"YOUR RECENT ARTICLES ON MERCEDES ARE STUPID. THEY CONSTANTLY SMART-MOUTH EXPENSIVE CARS AND EXPENSIVE-CAR BUYERS."

◀

Explained:

How come vehicles in the U.S. are almost always equipped with all-season tires? Even the high-performance cars get all-season tires. Why aren't these equipped with summer (or three-season) tires?

I can imagine the reason for the North and Midwest is the cold, wet, and snowy weather, but I noticed that the cars in the warmer regions, such as California and Florida, also come with all-seasons.

For performance cars, it defeats the purpose, or maybe there is a grand plan behind all this. When I ask owners or car dealers, nobody seems to know.

—Marc van Sprang
Brussels, Belgium

All-season tires are largely a North American phenomenon. Audi product management says: "Our U.S. customers expect to drive their Audi in all weather conditions without the added complexities involved with owning a second set of tires. With this, we have seen a greater preference in all-season tires and have packaged [our cars] accordingly." Slightly more than 5 percent of new cars in the U.S. and Canada are sold with summer tires according to IHS Markit, and Michelin estimates that just 2 or 3 percent of U.S. drivers change to dedicated winter tires because the rest either live outside the Snowbelt or their winter is regularly mild enough not to warrant the effort. Another factor is the lack of government oversight. In many European countries, winter-tire use is compulsory, though some Old World residents are adopting "all-weather" tires that are safe year-round and meet winter-traction requirements. If these more extreme all-season tires are what you want, look at the Toyo Celsius or the Nokian WRG3.
—K.C. Colwell

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quality of their components, but apparently Land Rover just lets the tooling wear out and then shrugs its shoulders when things go wrong. After decades of reliability, suddenly pushrod cups, which are staked in place in the cast rockers, started to loosen up and make noise. It started in the 4.0 V-8 and followed right up until that poor engine was put out of its misery with the LR3.

2. Worn-out cam with mushroomed lifters. Being as this was/is a flat-tappet pushrod engine living in a roller-follower overhead-cam world, there isn't enough zinc in the oil to properly lubricate the old girls, and they grind like Miley at an awards show. It was always a hoot to have a dealer swap in a fresh bullet only to have them call back a week later with a truck with an engine that has the same get-up-and-slow and cacophony of a mid-'80s Volkswagen Rabbit diesel running two quarts low.

3. Finally, my all-time favorite: loose cylinder liners. This is always good for a laugh, tapping noise, and sometimes a little coolant loss. Wastes a lot of a technician's time and a lot of a customer's money replacing damn near everything except the cylinder block. But it can't be. How could this happen? Well, because Land Rover.

Truth be told, if I were in the same contest, I would have made the same choice in vehicle except I would have used an earlier Discovery with a better departure angle. Getting an old Discovery for one of these challenges is almost cheating; it is nearly unstoppable once you get it running.

—Ray Hagemann
Just-South-of-Armpit, NJ

BLUE OH FACE

Your December 2016 "How the Chaste Make Haste" article about the 2017 Ford Fusion Sport was informative. Last month I was able to drive an early model at a Ford dealership in Hillsboro, Oregon. It is everything you say it is, and I am looking for a vehicle to replace my aging Taurus SHO, which has been the best

"I ENJOYED THE 'BATTLE OF THE OFF-ROAD BEATERS' STORY. THE ARTICLE ALREADY HAS ME PORING OVER CRAIGSLIST POSTS, TRYING TO FIND AN OLD GEO TRACKER."

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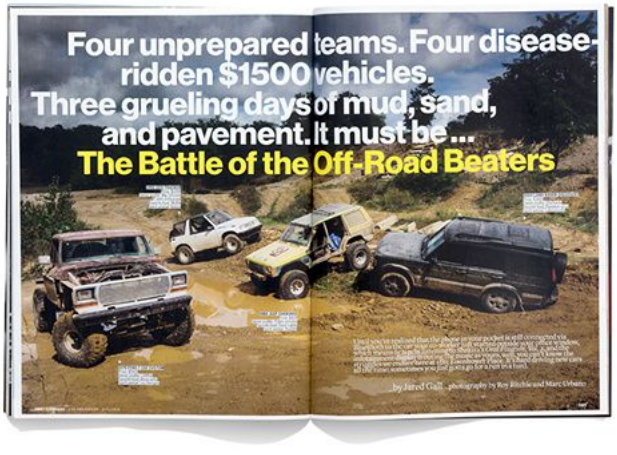
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The Battle of the Off-Road Beaters

Editor's Letter:

You hear a lot these days about "car sharing," the vehicle-usage model that allows people in a network to borrow cars as they need them. It's the part of the post-ownership society that sounds most to me like a psychological substitution for wife swapping. But car sharing promises to increase per-vehicle efficiency, as the typical car or truck spends around 95 percent of its life just sitting around.

Here at *Car and Driver*, we've been running our own car-sharing pilot program for well on to six decades. It's called the "car board," and it allows editors to sign themselves out in a different car each night, depending on what's in our lot. While successful in many regards—who doesn't want to spend an evening in a new Lamborghini Huracán?—it is also a complete pain in the ass.

For one thing, you can't leave items in any car. For me, that means schlepping my watchmaking loupes, Connect 4 game, and espresso machine into the office every day. And God forbid anyone leaves sunglasses or gum in a vehicle—they're as good as gone, snapped up by one of the wolf-raised miscreants I like to call my co-workers. Egg salad, however, always seems to escape the purview of these janitorial endeavors.

Secondly, Bluetooth. I currently have the passkeys for 57 cars in my phone. An embarrassment of them are for Corvettes and AMGs, Rs and Vs. Sounds great, right? What's the big deal about having so many cars linked to one's phone? Well, how about this scenario: You arrive at work midway through a sensitive and ostensibly private conversation with your urologist. You park next to someone who's just arrived at the office lot in the car you drove the day before. She's sitting there, minding her own business, making notes in the car's logbook. Then her car's Bluetooth picks up your very personal and graphic conversation with your medical professional. I'm not saying this happened, and neither is she. But I'd imagine that small talk in the break room would be awkward for you both from there on out.

There's a reason each of us still owns at least one personal vehicle that never shows up on the car board. Sharing has its ups and downs.

—Eddie Alterman

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Letter of the Month:

For me, Mr. Robinson's December column was déjà vu all over again. I had a similar experience to Aaron's Lamborghini engine misfortunes while he was en route to Pebble Beach. Recently my 1997 Hyundai Accent was missing badly while en route to Walmart. I was barely able to reach a parking spot. Luckily a homeless gentleman, who had just pilfered a shopping cart, acutely noted that my engine woes were due to a potato someone had stuck in my tailpipe.

—Hintz, Roseville, MN

vehicle I have ever owned (I have been an American-car driver for 58 years). However, I now learn that the Lincoln MKZ (same chassis as the Fusion's) will offer all-wheel drive and 400 horsepower. I hope you can get your hands on one and compare it to the Fusion Sport in performance, specs, and price.

—Robert J. Braud
St. Helens, OR

Ford shareholders should be tickled to learn that Ford is spending good money on making nice noises instead of better cars—or at least good ones.

—Pierre Drolet
Cap-Santé, QC

Your review of the 2017 Ford Fusion was right-on. I have had one for six weeks, and everything you say is true. I only have one mild complaint: I am still adjusting the driver's seat. Having owned Fords and Lincolns for years, I must rank this toward the top. It's a great, fun car to drive. I highly recommend this ride.

—Bruce W. Severn
Levittown, PA

FIVE FOR FIGHTING

Great to hear that Audi has finally come full circle and the five-cylinder engine is back ["RS Kicker," December 2016]! Here's to hoping it trickles into more of its vehicles. As the previous owner of a 1982 Coupe GT, 1987 5000CS, and a 1991 200 Turbo Quattro, [I have to say] the five-cylinder engine is why I kept buying its cars. Stephan Reil is correct in saying: "And of course there's the sound. Nothing sounds like a five-cylinder turbo," and that's what hooked me. Now all Audi needs to do is to bring back the iconic open headrests of yore to seal the deal.

—Rick Casorio
Allenton, MI

GIVES ME THE WIND

It was a pleasure reading your article on the scientific explanation of the intrusive buffeting when a rear window is down ["A Mighty Wind," December 2016]. Always so aggravating. I will beg to differ about your comment that it's as loud as standing next to a Boeing 767 engine at takeoff power, though. Anyone experiencing that would have on ear protection and be very careful where they are standing, and their teeth would rattle. A rear window down at any speed is comparatively quiet.

—Mark Miller
Clackamas, OR

TRUCK STOPS

Regarding your article on the tragic results from heavy-truck accidents ["Axles to Grind," December 2016]: Often rear-ending other vehicles, as you describe, could surely be reduced or eliminated by trucks being fitted with forward-sensing and automatic-braking technology as currently available on many passenger cars.

I realize cost would be a factor, but I would think the insurance claims resulting from such accidents would enable much lower rates to be offered to trucks fitted with this capability.

—Chris Barnett
Toronto, ON

The main cause of accidents by far is driver distraction. And, in the case of truckers, fatigue. Slowing them down a little would be good but not the solution to their crash problem. Trucks crashing into cars at speed is pure driver stupidity, and no amount of speed limiting can prevent that.

—JC
El Paso, TX

Surprised that Clifford Atiyeh didn't address what seems to be the biggest flaw with NHTSA's plan to govern speeds of heavy trucks. Wouldn't controlling speeds at levels much lower than surrounding traffic create more of a hazard? If NHTSA moves forward with its plans, shouldn't it also restrict governed vehicles to the right lane? As it stands, it seems its plans will create more problems than it will fix, or is that implied when governments get involved in fixing something?

—Russell Read
Mount Pleasant, SC

DRIVEN TO DISTRACT

Eddie Alterman plunges his (literary) knife into the beating heart of the frightening increase in traffic accidents and fatalities: more high-profit, high-speed data designed into moving vehicles ["Guidance for the Care and Feeding of Automated Vehicles," December 2016].

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—Steven Perry
Hendersonville, NC

I think what you're saying is that it's all about the Journey—Ed.

WINGS CLIPPED

I love reading *Car and Driver*, but how many times do we need to read about Aaron Robinson talking about his Cessna airplane ["Fixing Vehicles on the Fly," December 2016]? I think it might be time he explore his passion and get a job at "I own a shitty plane magazine" or "let's all flaunt that we wanna be a real aircraft pilot magazine." Enough already, trade the crappy Cessna for an old rusty Z/28 or something and let's talk about cars. I have no interest in reading about how duct tape is holding his aircraft together so well next month. Enough already!

—Whittier Peirce
Danbury, CT

If the tape fails, you might not have to—Ed.

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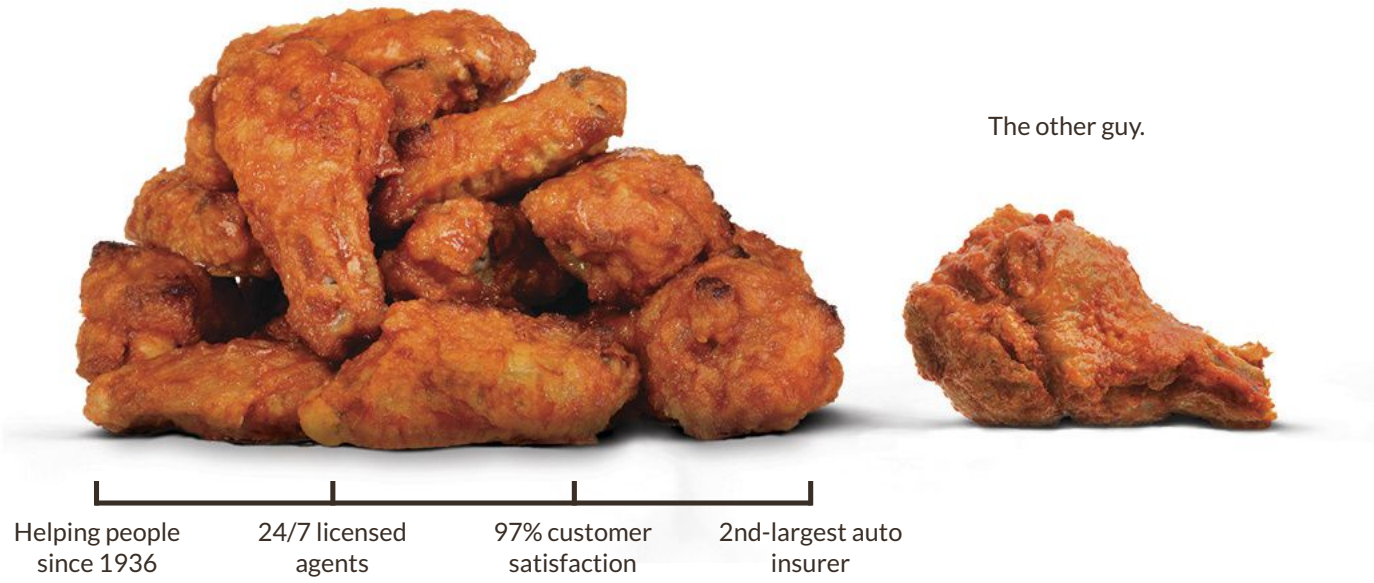

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CAN THE CAR THAT INTRODUCED A BRAND REINVENT IT, TOO? LEXUS THINKS SO.
by Jared Gall

001

Reveal of the Month

TURNING JAPANESE

JAPAN IS A UNIQUE PLACE. Where the Japanese see a delightful bowl of raw sea urchin and salmon roe, most Westerners see a slimy pile of bug and guts. And for the really fancy meals, you take your shoes off and sit on the floor.

It's understandable, then, that Toyota strove for familiarity with the first-generation LS400, which introduced the Lexus brand to the world in 1989. It was, in the words of one company representative, an attempt to "out-German the Germans." In pursuit of this goal, Lexus went so far as to mimic the processes and chemicals used to treat leather in European tanneries to ensure that its interior smelled "right." However, 28 years later, Lexus is now intent on distinguishing Japanese luxury from its European forms, and it's betting the all-new LS can do it without boguing anyone out.

001
Designers tell us it took six months to perfect the design of the grille's matrix, which has 5032 facets.

photography by GREG PAJO

▼ INTERIOR

When you think Japanese luxury, you should think of plump sofas. At least, that's the message LS buyers will get, because the design team's goal with the seats was to create the impression of sinking into a big, comfy couch or easy chair. They paid close attention to the relationship between the padded center-console lid and the door-mounted armrests, the latter seeming to float apart from the door panel with ambient lighting tucked behind to further the illusion. And if you happen to be sitting opposite the chauffeur in the right-rear easy chair, Lexus claims best-in-class legroom with the seat fully reclined and the front-passenger seat leaned up against the dash.

Seats aren't the only place where the LS departs from other Lexus designs. The interior as a whole is warmer, more welcoming, and more organic in its forms than other Lexuses. Six thin bands of magnesium span the dash, beginning at the driver's door before bunching up as they bend up and over the instrument panel, then fanning back out as they continue their stretch across the dash to the passenger door. Contrast-stitched leather is de rigueur in a modern luxury car, but the LS is the first that we can recall to have it around the gauge faces.

RAKE'S PROGRESS
Designers kept the windshield rake close to that of the LC to emphasize sportiness. This also means a 57.1-inch height, among the lowest in its class, and lower, even, than the ultraslick Jaguar XJ.

▼ PLATFORM

The LS will share more than its position at the top of the company hierarchy with the LC coupe. Both ride on versions of the same platform, the LS's stretched a foot and a half over the coupe's. Like its two-door sibling, the LS uses aluminum for much of the suspension and its mounting points, as well as the bumper beams. The two cars share a multilink front suspension and a five-link rear assembly, though Lexus made sure the LS's dampers and bushings would supply more comfort than the LC's.

As with the outgoing LS, the new sedan has adaptive stabilizer bars but now adds rear-wheel steering. Coil springs will be standard, with air springs optional. Like other manufacturers of air-sprung crossovers and SUVs, Lexus has programmed the LS with an "entry" height. Here, though, as opposed to those relative

001
IN AN APPARENT EFFORT TO MAKE PRIUS OWNERS FEEL AT HOME, LEXUS ADOPTED THE HYBRID'S DOPEY SHIFT PATTERN. BUT THE SHIFTER ITSELF IS A LOVELY PALM-SIZED LEATHER NUGGET.

002
TAILLIGHTS THAT LOOK LIKE THE SLASHED FLESH OF A BEAST WITH HELLFIRE FOR BLOOD ARE NOW A SIGNATURE LEXUS STYLING ELEMENT.

003
THOSE WOUNDS MIGHT HAVE COME FROM THE CHROME LOWER-BODY STRIP, THE REAR-MOST EXTENT OF WHICH IS MEANT TO EVOKE A KATANA BLADE.

LEXUS STYLISTS SOUGHT A MIDDLE GROUND BETWEEN THE TRADITIONAL SEDAN SILHOUETTE AND THE BURGEONING FOUR-DOOR-COUPE AESTHETIC.

▼ STYLING

From the outside, it appears as though Lexus thinks Infiniti and Mazda do Japanese style well. Aside from lesser Lexuses, it's the form language of those brands that the LS emulates most, with its flowing compound curves juxtaposed against sharp creases. Lexus's spindle grille again rivals a largemouth bass for maximum maw-to-face ratio and, as on the new LC coupe [see page 082], the spindle shape repeats on the trunklid and rear fascia. Also shared with the LC is the dramatic rake of the LS's windshield. Overall, the LS is rather low and sleek for such a large car. Lexus stylists sought a middle ground between the traditional sedan silhouette and the burgeoning four-door-coupe aesthetic. In profile, the LS is a sedan with a slightly swoopy D-pillar, but viewed more from the front, the car's tapering haunches mean the trunklid disappears and the car takes on a distinct hatchback crop, like a Japanese Porsche Panamera.

high-riders that kneel to let occupants in, the LS's entry mode raises the body up on its tippy-toes. It's a simple and clever accommodation that we appreciate even more since it erodes a cornerstone of the crossover's success: its easy, slide-sideways ingress.

▼ POWERTRAIN

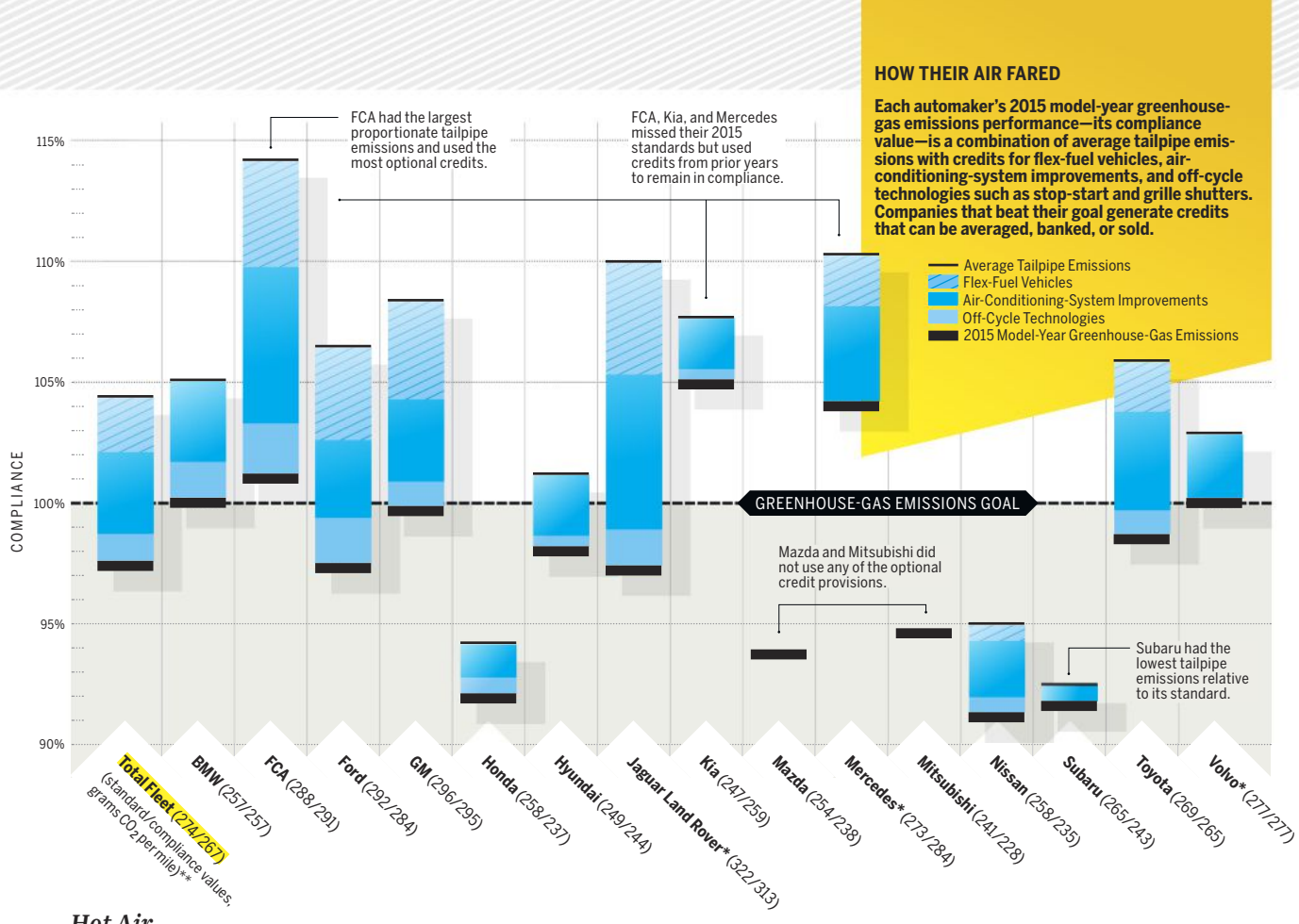
At its launch, the LS will be powered by an all-new twin-turbocharged 3.5-liter V-6. The 60-degree block and heads are aluminum, and a pair of turbos developed in-house are integrated into the exhaust manifolds. The engine's signature, however, is an exceptionally long stroke—100.0 millimeters in an 85.5-millimeter bore—that Lexus claims enables the engine to achieve new levels of thermal efficiency. It also allows it to make 414 horsepower and 443 pound-feet of torque.

Backing up the six is an all-new Aisin 10-speed automatic. Like the Ford/GM 10-speed [see "Explained," page 059] that recently made its debut in the F-150 and Camaro ZL1, it's aimed more at packaging CVT-like flexibility into a traditional automatic than stretching the overall ratio spread—though, of course, it does achieve the latter as well.

Rear-wheel drive is standard on the LS, while all-wheel drive will be an option. Lexus isn't discussing other powertrains yet, but this being Lexus—and with the LC offering one—we expect a hybrid to join the lineup shortly. And with the Germans all packing V-8s and even V-12s in their full-size sedans, Lexus would be foolish to cap the LS at six cylinders. We do not believe Lexus is foolish. Nobody at Lexus will cop to it, but, seeing as Lexus's current V-8s all date fairly deep into the last decade, we suspect they're working up a new one to take on the smaller, higher-output Teutons.

▼ CRYSTAL BALL

Our preview of the Lexus LS included a short drive of some early engineering mules. Engineers were still finalizing powertrain calibrations, so we can't comment on the twin-turbo six at this time. But with the optional air springs, the ride is excellent, and the rear-wheel steering helps the LS feel surprisingly nimble without compromising straight-line stability. The steering is satisfyingly hefty and the brake pedal progressive. The original LS won the first comparison test we threw it into in 1989; we'll find out in another year or so if its latest descendant can repeat that feat.


HOW THEIR AIR FARED
Each automaker's 2015 model-year greenhouse-gas emissions performance—its compliance value—is a combination of average tailpipe emissions with credits for flex-fuel vehicles, air-conditioning-system improvements, and off-cycle technologies such as stop-start and grille shutters. Companies that beat their goal generate credits that can be averaged, banked, or sold.
Average Tailpipe Emissions
Flex-Fuel Vehicles
Air-Conditioning-System Improvements
Off-Cycle Technologies
2015 Model-Year Greenhouse-Gas Emissions
FCA had the largest proportionate tailpipe emissions and used the most optional credits.
FCA, Kia, and Mercedes missed their 2015 standards but used credits from prior years to remain in compliance.
Mazda and Mitsubishi did not use any of the optional credit provisions.
Subaru had the lowest tailpipe emissions relative to its standard.
GREENHOUSE-GAS EMISSIONS GOAL
COMPLIANCE
115%
110%
105%
100%
95%
90%
Total Fleet (274/267) (standard/compliance values, grams CO2 per mile)**
BMW (257/257)
FCA (288/291)
Ford (292/284)
GM (296/295)
Honda (258/237)
Hyundai (249/244)
Jaguar Land Rover* (322/313)
Kia (247/259)
Mazda (254/238)
Mercedes* (273/284)
Mitsubishi (241/228)
Nissan (258/235)
Subaru (265/243)
Toyota (269/265)
Volvo* (277/277)

*Participated in a program for low-volume carmakers that allowed a portion of its production to adhere to alternate standards.

**Calculations are weighted according to vehicle life cycle. Rounding may cause some discrepancy with totals.

Hot Air

GAS CARDS

ANOTHER PASSING ENVIRONMENTAL GRADE FOR THE AUTO INDUSTRY? SORT OF.

by Jeff Sabatini

LOST AMID THE PRE-ELECTION furor over Pussygate, #podestaemails, Russian hacking, and all the fake news in America's Facebook feed was the auto industry's greenhouse-gas report card for 2015. Issued in early November 2016, it was unsurprisingly good. Carmakers are now collectively four-for-four in exceeding the EPA's de facto fuel-economy targets since they took effect for the 2012 model year. Then why, you might ask, did Auto Alliance, a trade group representing most of the automakers, fire off a letter to President-elect Trump just two days after the election, bemoaning its regulatory plight?

Not to be confused with the similar NHTSA-administered Corporate Average Fuel Economy program, the EPA's greenhouse-gas emissions standards are based on the actual vehicles each company sells and incorporate incentives and credits that go beyond those available under CAFE statutes. Some carmakers prefer these more flexible rules, while others seem happier paying CAFE fines, a resolution not offered by the EPA. Regardless, no company has yet fallen out of greenhouse-gas emissions compliance (although Volkswagen's status is pending, based on the EPA's ongoing Clean Air Act violation investigation). Compliance is getting tougher, though. Standards have increased by only 8 percent over the first four years but are projected to be 40 percent stricter by 2025. A temporary program for small carmakers that allowed some vehicles to adhere to a lower standard—used by Jaguar Land Rover, Mercedes, and Volvo—ended after 2015. And credits for flex-fuel vehicles, which many automakers have been using to comply with the law, are being depreciated.

But it's not so much the EPA's tightening screws that have the carmakers frustrated as it is the "regulatory friction" between the greenhouse-gas rules and CAFE. Auto Alliance says it anticipates "potentially billions of dollars in fines" from NHTSA, even if the industry is square with the EPA. Carmakers are also worried that consumers won't be willing to buy costlier electrified vehicles, especially if gas prices remain low. And then there is the hated California Air Resources Board (and the nine left-leaning states that follow its rules), which persists in requiring high percentages of zero-emission vehicle sales, despite the Obama administration's promise of harmonization among the three sets of regs.

Harmony of any sort, however, seems as unlikely as Trump Republicans remembering that it was Richard Nixon who created the EPA. Shortly after the 2016 election and months before its deadline to do so, the agency moved to solidify greenhouse-gas emissions standards for 2022–2025. A week later, Oklahoma attorney general Scott Pruitt, a climate-change skeptic who has sued the EPA to block environmental rules, was selected to run the agency. We can only wait to see how this plays out. We wonder what Tricky Dick would think.

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PEDAL DANCE

TESTING LOW-GRIP DRIVING TECHNIQUES, USING WISDOM FROM A RALLY CHAMPION AND A ROCK STAR. ***by Josh Jacquot***

NO ONE HAS EVER understeered their way to driving glory. In addition to being the enemy of driving pleasure, understeer, if potent enough, has the magical ability to reshape the front end of your car. It's bad.

Pendulum turns and left-foot braking, practices common in the world of low-grip driving, also happen to be understeer's greatest foes. This test measures the effectiveness of those techniques. The goal, in this case, is to destabilize the chassis and point the drive wheels in the desired direction, allowing earlier throttle application and faster exit speed than is achievable using conventional road-racing techniques. Or so goes the theory.

Tim O'Neil, winner of five U.S. and North American rally championships and founder of the Team O'Neil Rally School, says there are multiple benefits of left-foot braking. High on his list: correcting understeer, inducing oversteer, and aiding timing in changing the direction of a slide. The great philosopher Sammy Hagar might have immortalized the notion of using one foot on the brake and one on the gas, but O'Neil helped perfect it.

Despite these benefits, carmakers and lawmakers alike take a dim view of destabilizing anything, especially a moving car. Accordingly, the practical application of this kind of driving is relegated to low-grip rally stages, rallycrosses, and other places less susceptible to the long arm of liability attorneys. To hammer home that point, we disabled the stability control, traction control, and anti-lock brakes on the otherwise stock Subaru WRX we used for this test.

But how well does it actually work? We took the WRX, our VBOX, and our left foot to the gravel, comparing the nuances of a pendulum turn to a conventionally executed one. Here's what we learned:

UNDERSTEER ASSASSIN

Taken from our VBOX data, the different lines in this illustration represent the actual paths created using each technique. Despite the Scandinavian flick, the left-foot-braking run (red) uses less road and is faster. The conventional line (blue) is slower partly because understeer causes it to miss the apex.

RESULTS

Left-foot braking with pendulum turn
Segment time: 6.0 sec
Exit speed: 40.5 mph

Right-foot braking with conventional turn
Segment time: 6.6 sec
Exit speed: 34.8 mph

photography by A.J. MUELLER, *illustration by* BRYAN CHRISTIE DESIGN

VEHICLE SPEED

Faster entry and exit speeds characterize the pendulum-turn run. Notice, however, that the low-grip technique is slower than the conventional one for a full two seconds in the middle of the corner. The point at which it becomes slower **(001)** corresponds to when the throttle is fully open and just before the peak yaw rate (see **013**) is achieved. In other words, it's the point where the car is rotating fastest. The driver sacrifices speed early to get the car pointed in the right direction sooner and exit at a higher velocity.

BRAKE-PEDAL POSITION

Despite entering the corner 3.5 mph faster using a pendulum turn and left-foot braking, our driver goes to the brake almost 15 feet later in the corner, as he's confident the car will turn rather than understeer. Notice the overlap of braking and throttle as the pendulum turn is initiated **(002, 005)**. Using the left-foot technique, peak braking is more aggressive (32 percent of the pedal travel versus 16 percent) **(003)** once the car is turned back to the left. Braking also ends sooner in the left-foot run **(004)**.

ACCELERATOR-PEDAL POSITION

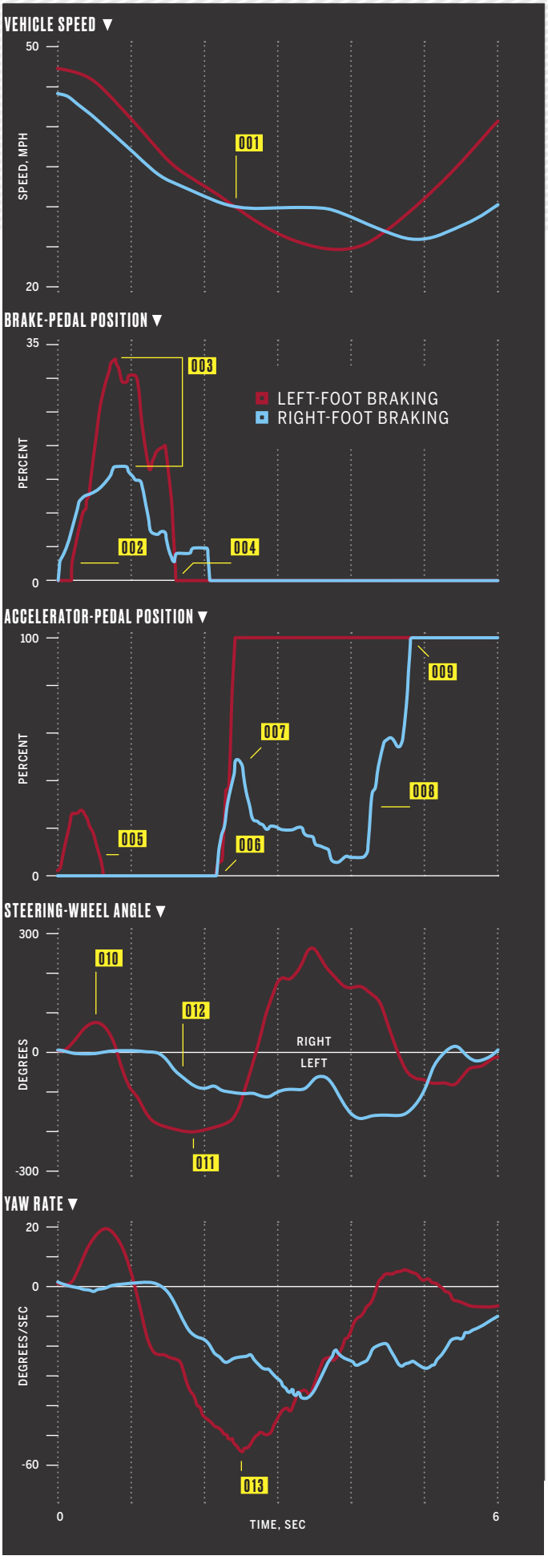
Our driver presses the accelerator at about 2.1 seconds in both runs **(006)**. His enthusiasm for the throttle comes early **(007)** in the right-foot-only run, however, and results in a lack of commitment. In that run, after reaching almost half-throttle, he backs off the pedal until later in the corner **(008)**, finally ramping it up to 100 percent **(009)**. Y'know, the usual male premature acceleration.

STEERING-WHEEL ANGLE

Notice that the left-foot-braking run begins with initial steering input to the right **(010)**. A small flick redirects the momentum from the initial juke to the right to rotate the car further to the left as it enters the corner. Countersteering starts at 1.8 seconds **(011)**, just as the right-foot-braking run's initial turn-in is beginning **(012)**.

YAW RATE

By measuring how rapidly a car rotates around its vertical axis, yaw rate illustrates how much quicker the left-foot technique pivots the WRX into the turn than a conventional turn would. See how peak yaw rate comes much earlier in the corner using left-foot braking **(013)**. Maybe the former Van Halen frontman was onto something when he said, "When I drive that slow, you know it's hard to steer." Maybe he should have used his left foot more often.



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Last month I drove our Honda Pilot to a resort in Ashton, Idaho, to fish on the Henry's Fork. The route led me through the Idaho National Laboratory, home of the Experimental Breeder Reactor-I, not to mention Mud Lake and Atomic City. I am still glowing.

I wound up shelling out about $100 for every trout I caught, although a 22-inch brownie—"six kinds of awesome," said the guide—induced a kind of fiscal amnesia. But then it began snowing, so I opted to drive home via the quickest route. The Honda's nav system suggested U.S. 20 north, then west on Idaho's Fort Henry Historic Byway. The byway, marked as "scenic," would lead to the village of Spencer and the U.S. Sheep Experiment Station, both on I-15. I estimated that the byway was perhaps 25 miles long.

The road started out fine, paved and everything, with maybe three inches of snow and exactly no human beings. I knew when the pavement ended because the Pilot [see Long-Term Test, p. 074] leapt six inches skyward after fording what I later learned had been a small stream. After that, there was just mud, interrupted by gravel swales and potholes the size of kiddie pools. In some places, the snow eradicated the road altogether. I can't remember exceeding 12 mph. An ugly front rolled in, with purple clouds rear-ending each other on the Centennial Mountains a couple miles north. The Pilot's altimeter indicated I was never below 5500 feet. The GPS showed a little icon resembling a dung beetle spinning in circles on a blank brown field of, well, excrement, it seemed to me.

Occasionally the road was visible almost to the horizon, a mile or two of cold nothingness to let me obsess on the apparent cessation of life as we know it. In places, I saw not so much as an abandoned barn or outbuilding. Sometimes there weren't even barbed-wire fences. No signs. My sense of critical distance collapsed. In theory, there should have been one village—Kilgore—but it apparently was a gassy aneurysm in some cartographer's stand-up routine. "Where's Kilroy?" came to mind. Also death came to mind.

I had set out at noon. Now it was nearing two thirty. A Dodge Ram dualie with snow chains came splashing in the opposite direction. "Does this road connect to I-15?" I asked the driver. "Eventually," he responded, his wife looking as if she'd only recently been let out of a box. "Is the road passable?" I asked. He thought about that for way too long, then said, "I suppose" and clanked away in a fog of diesel fumes.

The Pilot was now coated in more gritty sludge than the average Louisiana swamp buggy. Not one piece of metal or glass was visible beyond the B-pillars. The rear wiper just skated over a hardening crust of opaque sediment. No one could see my brake lights, but there was no one to see them anyway. So much crud collected in the wheels that I felt a paint-shaker imbalance coming on. The left-rear door was sealed shut.

It became so dark that I switched on the high-beams. I think there were six warning lights glowing on the Pilot's IP. I felt as lost as Robinson Crusoe's cat and was swallowing the acidic bile of panic every couple minutes, contemplating how I'd fumbled into this monochromatic *Black Mirror*. I drove another 60 minutes—now 3.5 hours total—with road and weather conditions morphing from merely awful to approximately appalling. I crested a small hill and fetched up against maybe 250 cows standing inert, blocking passage. We—them, me—all expressed the same look of wonderment. I nudged the Pilot through the herd slowly—a kind of black-and-white parting of the Red Sea. I tell you, it is sobering to see an animal's head as big as a microwave oven only two inches from your nose. Then I encountered a full-fledged Marlboro man in Carhartts, leather chaps, crap-splattered Stetson, and what looked like—I swear—an Hermès silk scarf around his neck.

"Am I near I-15?" I pleaded, revealing a few sharp misalignments in my psyche.

"Wow," he responded as he casually scanned the Pilot, which by then was a massive molten fondue of mud. "You drove the whole thing, didn't you?"

I've encountered such black-hole vortexes before. I once flew to Ottawa, Ontario, for instance, and rented a Dodge Charger mid-blizzard. I immediately got lost and wound up in Hull, Quebec—wrong side of the river, but close—where no human beings were on display. Nuclear winter, I thought. So I dashed into a McDonald's, almost hugging the clerk, then asked, "Where's Ottawa?"

Crickets, as they say. Her face was blue, as if she might be low on oxygen.

"Ottawa," I repeated, using more volume. "It's the capital of your country."

She turned and said something in French to the staff, who all stared, fingers poised to tap out 9-1-1.

When you see "scenic" on a map, it does not necessarily mean it should be seen.

John Phillips

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Every other Saturday around 8:00 a.m., Robert Roach rolls up the doors of the cluttered auto shop at Carson High in south Los Angeles and welcomes anyone who wants to stop by. During the week, Roach teaches auto shop

at the school, and on odd weekends the Boys and Girls Club of Carson kicks in a few bucks to sponsor "Cars & Guitars," Roach's informal name for these Saturday gatherings. When I poked in the other day, about 15 young people were there, both current students and alumni who have moved on but are still drawn back to friends and comfortable surroundings. A pair of teenagers dabbed paint on a metal stand on which an old Buick V-6 had been partially stripped and its parts labeled for learning. Another was pulling the front springs off a well-worn Studebaker pickup. And, sure enough, a couple of kids were strumming guitars. Oil changes, brake jobs, and pet go-kart and ATV projects are common activities on these Saturdays.

You may recall Roach from a column I wrote back in 2012 about the decline of high-school auto shops and the failure of public education to recognize that America needs people who can make and fix things as much as it needs English-lit majors. Every so often, Roach emails me with the latest twists and turns in the fate of Carson's auto shop. He spends a lot of his free time writing grant proposals and talking to car companies and others about donating castoff stuff for the kids to learn from. He's excited about a grant proposal that he recently submitted to the RPM Foundation, which supports education in restoration and preservation.

Get to know Roach, and you become convinced that just about everything good happens because of the initiative of one or a few tireless individuals swimming against a current of indifference. When these people disappear, often so does the good. To wit: An amazing after-school program at Honda's nearby U.S. headquarters that gave kids introductory training as auto technicians has since quietly folded because the Honda manager who volunteered to make it happen got moved up the ladder. So far nobody has stepped in, though the company has since donated tools to Carson's shop, which also has come face to face with the ax several times. "Three months ago, the principal knocked on the door, and I thought that was it," says Roach. The constant uncertainty over whether the shop will live or die has made Carson "a very weird place," he says, "but I've gotten used to it."

Charter schools and other options have taken a bite out of Carson's enrollment, and as the student population shrinks, so does the funding. In response, the school broke apart a couple years ago, two pilot schools spinning off completely and the remainder reorganizing itself into three "small learning communities" with their own separate principals and administrators. Roach's class is part of the ESET academy, or Environmental Science, Engineering, and Technology. Other incoming ninth graders are plugged into the Global Business or Performing Arts academies, depending on where there's space. Students often don't have a choice, and the school has made it hard for kids in the other tracks to take auto shop as an elective. Roach has heard from kids who want to transfer into ESET but the school won't let them.

Roach is only given $200 in classroom budget per school year, which isn't enough to buy a decent torque wrench. So all the tools and cars are begged or borrowed or left over from former glory days. Some of the teaching aids hanging from the walls date back to the points-and-condenser era.

Which is okay with Roach, since he doesn't see his job as preparing high-school kids to become Porsche techs. That happens further down the line, in the much better-funded and -equipped programs at some of the local community colleges. His mission, as he sees it, is to not lose the kids before they even get that far by giving those who prefer sockets and spark plugs to sonnets and square roots a reason not to drop out. Roach teaches automotive survival skills, like tire changes and jump-starts, as well as shop safety and basic system knowledge. "Applied chemistry and physics with a real-world practicality," he says.

If you were to ask your teenager where he or she is going on a Saturday morning, would it concern you to learn that it's the high-school auto shop? Me, neither. What might concern you is that as the nation tilts increasingly toward school fragmentation over the universal public-education system that built this nation, the options for kids who want to work with their hands are shrinking and are becoming entirely dependent on the efforts of individuals like Robert Roach.

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WELDING IS NOT PERMITTED NEAR A GAS TANK BECAUSE A WELDING FLAME APPLIED TO A CLOSED PIPE OR TANK MAY CAUSE AN EXPLOSION.
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THE WALLS OF CARSON'S AUTO SHOP: A COLLAGE OF QUAINT ANTIQUE TEACHING AIDS AND STUDENT PROJECTS.

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March 04-05	*March 18-19*	*April 29-30*	*May 19-21*	*June 23-25*	*August 4-6*	*September 9-10*	*October 7-8*	*November 10-12*	*November 17-19*

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I don't know quite how I developed the need for a street-legal golf cart, but once I got the notion, it was unshakable. I'm happiest when I feel as if I'm getting away with something, and cruising around town in a goofy open-air

electric buggy—no doors, no worries—seemed like the kind of thing I should be doing. So I started scanning eBay, Craigslist, and even golf-cart forums (oh, don't pretend you've never been on Buggies Gone Wild) looking for my new ride. I soon learned that putting a cart in my garage was going to be more expensive than I'd thought.

Non-street-legal golf carts are cheap. But the ones you can register conform to a different set of rules, the ones that apply to low-speed vehicles (LSVs), a class of machine that was developed for gated communities in Florida where the HOA dictates the height of the grass, and every second Tuesday there are orgies in the secret dungeon under Sue's house. LSVs need VINs, seatbelts, and a DOT-compliant windshield, among many other miscellaneous features necessary to achieve a modicum of roadworthiness. Most exciting from an enthusiast's perspective, LSVs have more power than standard electric carts. As in, maybe five horsepower. But you can soup them up to seven or eight ponies if you're the kind of person who thinks too much power is never enough.

Whilst on the lookout for an LSV, I tested a new Mitsubishi i-MiEV, a vehicle that's not much bigger than a two-row cart. It turns out that secondhand i-MiEVs, with their 66 horsepower and rear-wheel drive, are priced the same as nice used golf carts. And the i-MiEV is more fun than it looks. I discovered that if I deactivated traction control, turned the front wheels to full lock, and brake-torqued off the line, I could coax the mid-motored Mitsubishi into a serious gravel-spraying fishtail capped by a graceful slide out into my paved cul-de-sac. In this manner, I am proud to say I accomplished a feat heretofore deemed impossible: laying down rubber with an i-MiEV.

The problem with the i-MiEV is that it's a car. A small car, yes, but a car nonetheless. Behind the wheel, you feel not an iota of naughtiness, no frisson of rules bent or broken. But I had an idea to rectify that, which I presented to i-MiEV owner Aaron Robinson at last year's Lightning Lap.

"I want to get an i-MiEV and *Mad Max* it," I told him. "Take off the doors. Maybe give it a canvas roof, jack it up a couple of inches, and put on fender flares." To which Aaron replied, "I'd expect nothing less from you." He went on to opine that the LSV-versus-Mitsubishi quandary was no quandary at all. "If you're going to spend the same amount of money," he asked, "why not get airbags and air conditioning?" Furthermore, LSVs top out at 25 mph, can only operate on roads posted at 35 mph or less, and generally use heavy lead-acid batteries that need to be replaced every few years or so. After careful consideration of Aaron's reasoning, I concluded that an i-MiEV made more sense in every way. So I bought a GEM.

GEM, for those not in the know, stands for Global Electric Motorcars, a name that surely reflects ambitions unrealized. I got myself a 2009 e4, which splits the difference between an i-MiEV and walking. It's studly, as golf carts go, with a coil-over front suspension, an aluminum frame, and four forward-facing seats. These days, GEM is owned by Polaris, but mine proudly wears a badge that reads "Global Electric Motorcars: A Chrysler Company." Hey, they can't all be Hellcats.

I scored my GEM from a GovPlanet surplus auction for two grand. The front end is emblazoned with a logo reading "NCHB-1," which means that my machine was used by Navy Cargo Handling Battalion One, making it possibly the least macho military vehicle since the ill-fated Northrop Grumman Tandem Assault Bicycle. Because the navy removed all the batteries, nobody had any idea of the mileage or if it even ran. But I took a chance, trailered the thing home from Virginia, and installed six new Trojan deep-cycle 12-volt batteries, each of which weighs nearly 100 pounds. After not-at-all-confidently wiring the batteries into what I hoped was a 72-volt pack, I plugged in the charger and prepared for sparks and explosions. Instead, the multicolor LED dash lit up, the odometer displaying 1087 miles. After a complete charge, I removed the optional doors (Uncle Sam sprung for all the goodies) and went for a spin. Rusty brake rotors aside, she was primo.

I'm proud of my e4, total investment of about $3400. Sure, I could've indulged in bourgeois excess and bought a fancy i-MiEV like Hollywood Robinson, but I stand by my decision. Not everybody needs luxury features like roll-up windows and safety. Sometimes you just want to feel the wind in your hair, smell the battery acid in your nostrils, and hear the bystanders asking, "Is that one of those things they drive around in airports?" If you say this isn't a real car, you're right. But it's definitely a real GEM.

Ezra Dyer

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The winners lose and the losers win in this latest test of amped-up four-doors.

_by Tony Quiroga

_photography by Charlie Magee

New Jersey
Z87 GHN
Garden State

CADILLAC ATS-V
Price: $78,930
Power: 464 hp
Torque: 445 lb-ft
Weight: 3839 lb
0–60 mph: 3.9 sec

THE NAME ALFA ROMEO CONJURES UP GHOSTS.

A brand that once ruled racing, gave a young Enzo Ferrari his start, and produced bubbly little *macchine* throughout the 1950s and '60s is also a company whose cars earned a reputation for electrical malignancies and for dissolving with the speed of an Alka-Seltzer tablet. Plop, plop, fizz, fizz.

Those ghosts define Alfa Romeo, simultaneously elevating and haunting the brand as it tries to launch its American comeback tour, attracting and repelling us in equal measure. We will not forget that, in the late '80s, we had two very charming Milanos fail to complete long-term tests. *Two.*

So it's with equal parts skepticism and excitement that we approach the Alfa Romeo Giulia, the beachhead of Alfa's return to America. Aimed squarely at the usual suspects in the compact-luxury-sedan segment, it starts at $73,595 in Quadrifoglio form, and with 505 horsepower it is equipped to take on some of the world's best sedans. Engineered and designed in Italy, the Giulia is built on FCA's new Giorgio rear- and all-wheel-drive platform that will also form the basis for Alfa's second mooring, the Stelvio SUV.

Breaking with our usual comparison-test protocol, we brought back all the players from the last test of this genre. Ordinarily, we'd only invite the test winner, in this case the BMW M3, but we recalled the also-rans from that comparo as well, even though they are unchanged since their last visit. The Cadillac ATS-V still has a twin-turbocharged 464-hp V-6 and Nürburgring-developed moves; the Mercedes-AMG C63 S still has a sugary-sweet 4.0-liter twin-turbo V-8 that pours out 503 horsepower.

Of the returning cast, the M3 has changed the most. BMW now offers the car with a Competition package, a $4750 option that includes 19 more horsepower from the twin-turbo 3.0-liter inline-six, forged 20-inch wheels with wider Michelin Pilot Super Sports, and a retuned suspension with new springs, dampers, and anti-roll bars. It's a more intense M3 that shifts the sedan toward the track-focused M4 GTS.

MERCEDES-AMG C63 S
Price: $94,770
Power: 503 hp
Torque: 516 lb-ft
Weight: 3958 lb
0–60 mph: 3.7 sec
BMW M3
Price: $88,045
Power: 444 hp
Torque: 406 lb-ft
Weight: 3662 lb
0–60 mph: 4.0 sec
ALFA ROMEO GIULIA QUADRIFOGLIO
Price: $79,195
Power: 505 hp
Torque: 443 lb-ft
Weight: 3822 lb
0–60 mph: 3.6 sec
Z87 GHN
GIULIA
MICHIGAN
033M129

2017 Cadillac ATS-V [+] A peace accord between ride and handling. [–] Cramped rear seat, hard to see out of, *True Grit* V-6. [=] Holds its own but lacks the refinement and space to rise to the top.

Inviting the entire group back allows us to give the Giulia the necessary context to accurately place it in the segment. At least that's the case we made in the editorial meeting. Actually, the truth is we wanted to play with all of these cars again. So we headed to the vast emptiness of Death Valley to exercise them and in the course of a few days drove 1100 miles. It took every bit of that distance to find a winner, because superiority in this segment is a game of inches.

4. CADILLAC ATS-V

Last place is now becoming too familiar to Cadillac's ATS-V. As before, it proved superior to the German sedans in ride and handling. Cutting up through the mountains that surround Death Valley, the ATS-V is a hero. Cadillac's magnetorheological dampers balance both wheel control and comfort better than the AMG and the M car. The steering feel earned top marks, there's big grip from the Michelins, and the brake pedal balances effort and travel, providing the right bite when you misjudge a corner and dive in too deep. We didn't find a road in our travels that the ATS-V couldn't master. So why didn't it finish higher?

We call the 3.6-liter twin-turbo V-6 to the witness stand.

There's no denying it has the power. In acceleration tests, the Cadillac passed 60 mph in 3.9 seconds and went through the quarter in 12.2 seconds at 117 mph. It's a snap to launch, too. Simply put your left foot on the brake and your right on the accelerator, raise the revs to 2000 rpm, and release the brake. No need for launch control here.

Where the six falls short is in the experiential details. At wide-open throttle, there are 83 decibels' worth of gritty moan. If the ATS-V is the only car you drive, the sound isn't that offensive, but next to the enchanting Mercedes V-8 that also powers AMG's GT S or the thundering Alfa V-6 derived from a Ferrari engine, it's apparent that this engine has humble roots. In another life without turbos, the ATS-V's six might have lived out its days in a Chevy Colorado. Even though it's not quite as powerful as the ATS-V's 3.6, we'd love to see how the Camaro's 455-hp 6.2-liter small-block V-8 would act in the ATS-V. We'd guess it'd work the same magic in the Cadillac as it does in the Camaro SS.

It's not only the engine that lets down the Cadillac. The interior elements fail to impress. Too many different materials collide inside; leather, carbon fiber, fake suede, and piano black don't play well together. And while the CUE touchscreen is now familiar enough not to seem so obtuse, the colors, fonts, and general appearance look low-rent next to the sharper and more sophisticated designs of the others. The ATS-V also has budget analog gauges that would be just good enough for a Chevy Spark, but here

► The ATS-V's chassis tuning and steering are top-notch, even in this group. But it's let down by a cramped interior and an uninspiring, though powerful, engine.

	2017 ALFA ROMEO GIULIA QUADRIFOGLIO	2017 BMW M3	2017 CADILLAC ATS-V	2017 MERCEDES-AMG C63 S
PRICE AS TESTED	**$79,195**	**$88,045**	**$78,930**	**$94,770**
BASE PRICE	$73,595	$64,995	**$61,690**	$73,725
DIMENSIONS				
LENGTH	182.8 in	184.5 in	184.0 in	187.2 in
WIDTH	73.2 in	73.9 in	71.3 in	72.4 in
HEIGHT	56.1 in	56.3 in	55.7 in	56.1 in
WHEELBASE	111.0 in	110.7 in	109.3 in	111.8 in
FRONT TRACK	61.2 in	62.2 in	60.6 in	63.3 in
REAR TRACK	63.3 in	63.1 in	60.5 in	60.8 in
INTERIOR VOLUME	**F:** 53 cu ft **R:** 41 cu ft	**F: 54 cu ft** **R: 42 cu ft**	**F:** 50 cu ft **R:** 34 cu ft	**F:** 50 cu ft **R: 42 cu ft**
TRUNK	**13 cu ft**	12 cu ft	10 cu ft	**13 cu ft**
POWERTRAIN				
ENGINE	twin-turbocharged DOHC 24-valve V-6 176 cu in (2891 cc)	twin-turbocharged DOHC 24-valve inline-6 182 cu in (2979 cc)	twin-turbocharged DOHC 24-valve V-6 217 cu in (3564 cc)	twin-turbocharged DOHC 32-valve V-8 243 cu in (3982 cc)
POWER HP @ RPM	**505** @ 6500	444 @ 7000	464 @ 5850	503 @ 6250
TORQUE LB-FT @ RPM	443 @ 2500	406 @ 1850	445 @ 3500	**516** @ 1750
REDLINE/FUEL CUTOFF	7000/7250 rpm	7500/7500 rpm	6500/6500 rpm	7000/7000 rpm
LB PER HP	**7.6**	8.2	8.3	7.9
DRIVELINE				
TRANSMISSION	8-speed automatic	7-speed dual-clutch automatic	8-speed automatic	7-speed automatic
DRIVEN WHEELS	rear	rear	rear	rear
GEAR RATIO:1/ MPH PER 1000 RPM/ MAX MPH	❶ 5.00/5.0/36 ❷ 3.20/7.8/57 ❸ 2.14/11.7/85 ❹ 1.72/14.6/106 ❺ 1.31/19.1/138 ❻ 1.00/25.1/182 ❼ 0.82/30.6/191 ❽ 0.64/39.1/185	❶ 4.81/4.6/35 ❷ 2.59/8.6/65 ❸ 1.70/13.1/98 ❹ 1.28/17.4/131 ❺ 1.00/22.3/163 ❻ 0.84/26.6/163 ❼ 0.67/33.3/163	❶ 4.56/5.7/37 ❷ 2.97/8.7/57 ❸ 2.08/12.4/81 ❹ 1.69/15.3/99 ❺ 1.27/20.4/133 ❻ 1.00/25.9/168 ❼ 0.85/30.4/189 ❽ 0.65/39.8/189	❶ 4.38/6.1/43 ❷ 2.86/9.4/66 ❸ 1.92/14.0/98 ❹ 1.37/19.7/138 ❺ 1.00/26.9/180 ❻ 0.82/32.8/180 ❼ 0.73/36.9/180
AXLE RATIO:1	3.09	3.46	2.85	2.82
CHASSIS				
SUSPENSION	**F:** multilink, coil springs, anti-roll bar **R:** multilink, coil springs, anti-roll bar	**F:** struts, coil springs, anti-roll bar **R:** multilink, coil springs, anti-roll bar	**F:** struts, coil springs, anti-roll bar **R:** multilink, coil springs, anti-roll bar	**F:** control arms, coil springs, anti-roll bar **R:** multilink, coil springs, anti-roll bar
BRAKES	**F:** 14.2-inch vented, cross-drilled disc **R:** 13.8-inch vented, cross-drilled disc	**F:** 15.8-inch vented, cross-drilled ceramic disc **R:** 15.0-inch vented, cross-drilled ceramic disc	**F:** 14.6-inch vented disc **R:** 13.3-inch vented disc	**F:** 15.8-inch vented, cross-drilled ceramic disc **R:** 14.2-inch vented, cross-drilled disc
STABILITY CONTROL	fully defeatable	fully defeatable, competition mode, launch control	fully defeatable, traction off, competition mode, launch control	fully defeatable, competition mode, launch control
TIRES	Pirelli P Zero Corsa Asimmetrico 2 **F:** 245/35ZR-19 (93Y) **R:** 285/30ZR-19 (98Y)	Michelin Pilot Super Sport **F:** 265/30ZR-20 (94Y) **R:** 285/30ZR-20 (99Y)	Michelin Pilot Super Sport **F:** 255/35ZR-18 (94Y) **R:** 275/35ZR-18 (99Y)	Michelin Pilot Super Sport **F:** 245/35ZR-19 93Y **R:** 265/35ZR-19 98Y

▼

CAR AND DRIVER TEST RESULTS

ACCELERATION				
0–30 MPH	**1.6 sec**	1.8 sec	**1.6 sec**	1.7 sec
0–60 MPH	**3.6 sec**	4.0 sec	3.9 sec	3.7 sec
0–100 MPH	**8.1 sec**	8.6 sec	8.8 sec	**8.1 sec**
0–160 MPH	24.2 sec	26.7 sec	28.8 sec	**22.5 sec**
1/4-MILE @ MPH	**11.9 sec** @ 121	12.2 sec @ 120	12.2 sec @ 117	**11.9 sec @ 123**
ROLLING START, 5–60 MPH	**4.2 sec**	4.3 sec	4.3 sec	**4.2 sec**
TOP GEAR, 30–50 MPH	2.5 sec	2.1 sec	2.3 sec	**1.9 sec**
TOP GEAR, 50–70 MPH	2.8 sec	2.8 sec	**2.7 sec**	2.9 sec
TOP SPEED	**191 mph** (drag ltd, mfr's claim)	163 mph (gov ltd, *C/D* est)	189 mph (gov ltd, mfr's claim)	180 mph (gov ltd, mfr's claim)
CHASSIS				
BRAKING, 70–0 MPH	**143 ft**	155 ft	150 ft	156 ft
ROADHOLDING, 300-FT-DIA SKIDPAD	**1.00 g**	0.98 g	0.99 g	0.97 g
610-FT SLALOM	**46.1 mph**	**46.1 mph**	45.5 mph	44.5 mph
WEIGHT				
CURB	3822 lb	**3662 lb**	3839 lb	3958 lb
%FRONT/%REAR	52.6/47.4	52.3/47.7	52.6/47.4	53.8/46.2
FUEL				
TANK	15.3 gal	15.8 gal	16.0 gal	**17.4 gal**
RATING	91 octane	93 octane	91 octane	91 octane
EPA COMBINED/ CITY/HWY	**20**/17/24 mpg	19/17/24 mpg	**20**/17/**25 mpg**	**20/18**/24 mpg
***C/D* 1100-MILE TRIP**	18 mpg	**20 mpg**	18 mpg	18 mpg
SOUND LEVEL				
IDLE	48 dBA	**46 dBA**	50 dBA	52 dBA
FULL THROTTLE	80 dBA	88 dBA	83 dBA	**79 dBA**
70-MPH CRUISE	68 dBA	70 dBA	**65 dBA**	68 dBA

Tested by TONY QUIROGA *and* DAVID BEARD *in California City, CA*

they are in a $78,930 sedan. Note to Cadillac: Pick an interior designer who loves watches and you might get better gauges.

It's also harder to see out of the ATS-V than the other cars. Small rear windows and a high tail might look good to some, but the drawbacks are obvious when you're trying to determine if that's a soccer mom or a California Highway Patrol Explorer coming up on your six. There's less space inside the Cadillac, too. The rear seats are tight enough to trigger a claustrophobic episode. In a game of inches, every fraction counts.

3. BMW M3

The last time around, the M3 eked out a slight two-point victory over a C63, but now it's swapped its gold medal for a bronze. The C63 hasn't changed—so what happened? This would be a good time for the Competition package's performance review.

Even on the base 18-inch wheels, a regular M3 is firm. In our last go-round, the M3 had optional 19-inch wheels, shrinking the sidewalls and hardening the blows to the suspension. Adding the Competition package's 20-inch wheels with hockey-puck sidewalls, stiffer springs and dampers, and thicker anti-roll bars degrades the ride even further, increases road noise, and effectively removes the veneer of refinement that makes an M3 tolerable on a daily basis. Part of the M3's appeal is its ability to fill every need, from track-day toy to romantic-dinner shuttle. The Competition package removes civility, and it even rejiggers the electronic modes, which means that comfort mode isn't very comfortable anymore. After a stint in the M3, every driver stepped out and commented on the noise. At 70 mph there are 70 decibels of tire and engine racket, the loudest in the group.

2017 BMW M3 [+] The best-steering M3, spacious and practical. [–] Loud, rough, and a bit spastic. [=] Always a contender, but the M3's Competition package moves it too far away from civilization.

Adding the Competition package does make this the best-steering M3 of its generation. The forces through the thick-rimmed wheel build naturally in every mode—we liked the lighter efforts of comfort mode the most—and the 0.98 g of skidpad grip improves upon the last M3's 0.97. Through the slalom, the nimble and reactive M3 tied the Giulia for the fastest speed. The M division exorcised every bit of flab from the chassis; it's good for track use but annoying in the real world. This is an overstimulated M3, meaning jumpy, amped-up, and eventually tiresome. Where's the "Settle Down" button?

There's no faulting the engine's power, even if we wish BMW would get rid of the silly sound amplification that booms at up to 88 decibels at full throttle. The engine revs hard and fast to 7000 rpm. Throttle response is nearly instantaneous, and there are few signs that this is a turbocharged inline-six. Equipping the M3 with the $2900 dual-clutch seven-speed auto brings launch control. Unfortunately, BMW's launch control doesn't get the M3 off the

► The M3 is the loudest, most hard-core of the bunch. Yet it also has this group's most spacious interior, the best outward visibility, and the greatest fuel efficiency.

► The C63's carbon-ceramic front brake rotors cost $5450, but you won't have to clean brake dust off the intricate wheels. Well, not off the front ones, at least.

line as well as the others manage. By 30 mph, the M3 is a tenth behind the Mercedes and two-tenths behind the Cadillac and Alfa Romeo. The launch rpm is adjustable to between 2800 and 3900 rpm, and we tried everything in between to lower the time, but its 4.0-second run to 60 is the slowest in the group and slower than an M3 without the Competition package. It did, however, pick up the fuel-economy prize with 20 mpg.

There's still plenty to love about the M3. At something closer to its $64,995 base price it offers excellent value, but pumping it up with options until it reaches $88,045 offers diminishing returns. It does remain a practical choice in the segment, bringing interior space that's lacking in the Cadillac and Mercedes. An upright greenhouse makes it easy to see out of and place on the road, and the lightweight seats from the Competition package fit well and adjust to the perfect driving position behind large and clear analog gauges. On the outside, the sheetmetal still looks fresh, and the Competition package's additional gloss-black trim is a welcome highlight.

But unless you spend your weekends at the track and your commute involves the Stelvio Pass, we'd skip the Competition package. A base M3 is fun no matter how you drive it. Making an M3 more extreme does make it marginally more exciting, but at the expense of its on-road contentment.

2. MERCEDES-AMG C63 S

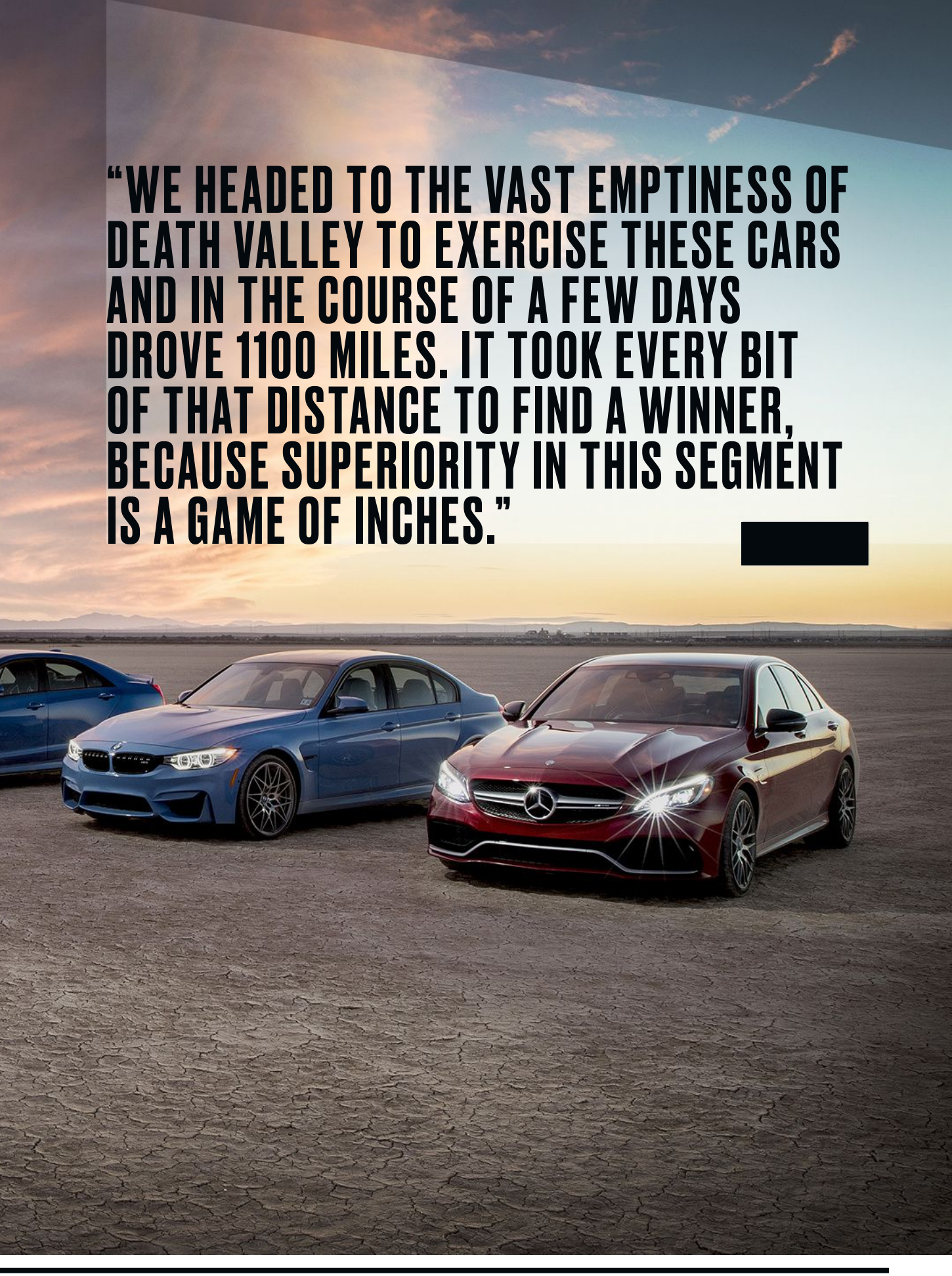
To the test equipment, these cars all look alike. But the test equipment can't appreciate the sublime nature of AMG's 503-hp V-8. It's the defining element of the C63 S and gives it a major advantage in a group of six-cylinders.

That engine comes with a $73,725 price tag, which doesn't seem too high for a luxury sedan that can clip off 60 mph in 3.7 seconds and hit the quarter-mile in 11.9 seconds at 123 mph. But that's just the opening bid; our test car came in at an S-class–like $94,770. Some of the extras included 19-inch wheels ($1250), AMG performance seats ($2500), carbon-ceramic front brake rotors ($5450), and the Premium 4 package ($5700), which adds many of the decadent features of the aforementioned S-class—right down to the air perfumer.

For all the extravagant extras and the S-class details inside, the real luxury flows from the V-8. It rips and pops through the $1250 performance exhaust when you want it to, but in normal use it wafts the Benz without straining or really even trying. Its fuel economy tied the smaller-displacement Alfa and Cadillac at 18 mpg. Every bit as smooth as it is powerful, the engine alone is worth the money, but it wasn't enough to make the Benz our winner.

A thick coat of refinement makes the C63 drive like a baby

2017 Mercedes-AMG C63 S [+] Eight not six, S-class features and refinement. [–] Pounding tires; almost as agile as the others, almost. [=] A few dance lessons away from a gold medal.



“WE HEADED TO THE VAST EMPTINESS OF DEATH VALLEY TO EXERCISE THESE CARS AND IN THE COURSE OF A FEW DAYS DROVE 1100 MILES. IT TOOK EVERY BIT OF THAT DISTANCE TO FIND A WINNER, BECAUSE SUPERIORITY IN THIS SEGMENT IS A GAME OF INCHES.”

2017 Alfa Romeo Giulia Quadrifoglio [+] Class-leading ride, handling, steering feel, and power. [–] You always wanted to be a development engineer, right? [=] Great to drive, possibly a greater gamble.

S-class. Isolation is ideal for those who never encounter apexes, but when facing a mountain, the AMG finds itself wanting for agility despite a suspension pulled in tight. If anything, AMG might've pulled it in too tight. No one lauded the AMG's ride. While not as manic as the paint-shaker M3, even with the Benz's dampers locked in their softest setting, the C63's Michelins sounded like bouncing basketballs as they slammed over pavement cracks. The steering churns with the same syrupy aloofness as an S-class's, and with 53.8 percent of its 3958 pounds on the front tires, the C63 S lacks the turn-in ambition of the others. Through the slalom, the AMG went the slowest while feeling the most ponderous.

The C63 finishes in second place again. Once again, it proves to be as good a daily as the *Wall Street Journal*, but there's now a better choice for those looking for a bit more entertainment.

1. ALFA ROMEO GIULIA QUADRIFOGLIO

Fresh out of the box, the Alfa Romeo won us over. We went in skeptical and left in awe of this gorgeous machine.

After rotating through the cars countless times, it became clear that the Alfa is the total package. The twin-turbo 2.9-liter V-6 provides the best acceleration to 60 mph and joins the 11-second club with an 11.9 in the quarter at 121 mph, quicker than Alfa's own 4C two-seater and quick enough to require a roll cage at some drag strips.

A Ferrari 488's V-8 with two cylinders lopped off, this 90-degree V-6 lacks a balance shaft but sounds great. Above 3000 rpm, the V-6 throbs out a deep, snarly bellow that jeers at the suave manner of the Benz V-8 and points at the coarseness of the Cadillac V-6. Piped-in sound isn't necessary here; all you hear is the music of the engine behind the instrument panel and the two-mode exhaust. We wouldn't want it any louder. Under duress, the engine peaks at 80 decibels, a big eight decibels quieter than the M3.

The power builds evenly and without any big surges, which helps keep wheelspin under control during acceleration. The throttle response is precise, no matter the mode, but becomes livelier in the race and dynamic settings. No launch control is necessary; it's as easy as holding the brake, revving the engine to 2000 rpm, and unleashing the power. We wish there were a manual-transmission option as there is in Europe, but we have to admit that the eight-speed automatic is spectacular. It bangs through shifts with nearly the swiftness of a dual-clutch gearbox, and the giant metal paddles attached to the steering column, which can completely obscure the wiper and turn-signal stalks in normal driving, are suddenly exactly right where you need them when you reach for a downshift.

► Three-quarters of a Ferrari V-8 is enough to make the Giulia the quickest car to 60 mph. Beyond 100 mph, though, the C63's full V-8 takes the lead.

While braking into corners, we did notice an annoying and inconsistent brake pedal. Alfa fits electrically assisted brakes to the Giulia, and they don't mete out braking forces with much consistency. Creeping to a stop in traffic is made difficult because the brakes keep slipping when you expect them to grab. Emergency stops are no problem, though, as the Giulia stopped from 70 mph in 143 feet. Credit the tires and the expertly calibrated anti-lock system.

Let's discuss tires for a moment. Alfa equips the Giulia Quadrifoglio with Pirelli P Zero Corsa Asimmetrico 2 rubber. Far more extreme than the Michelin Pilot Super Sports on the other three competitors, the Corsas are track-day numbers that owners will likely need to replace every 5000 to 10,000 miles. We'd call them cheater tires, but there's no rule stopping the others from offering equally aggressive rubber. Rolling on Super Glue, the Alfa pulled 1.00 g on the skidpad.

With the exception of Porsche's 911 and 718 Boxster/Cayman, there is no other 1.00-g chassis that rides as well as the Giulia's. The electronic dampers provide transcendent wheel control and somehow round off bumps that would ring through the BMW and Mercedes. Even in the hardest of the three modes, the suspension remains civil in a way that eludes the German sedans.

Next to the competition, the Giulia's steering is on the light side, but that lightness and the chassis' agility helped it ace the slalom test and made the Giulia the go-to car for leading the group through unfamiliar corners. It's not until you step into the other cars that you fully appreciate how well the Giulia changes direction.

There are a few things the Giulia doesn't do well. Apparently, no one thought of making it possible to disable the automatically backtracking driver's seat when you turn off the car. Alfa promises to fix that for 2018. The bottom cushions are a bit short, and the hard B-pillar trim is an elbow poker. Despite that, we did find a comfortable seating position. The interior design blends a lot of Mazda cues with some Ferrari flair. It's familiar and attractive, but not as rich as the AMG's interior. A leather-topped dashboard looks and feels expensive, but the lower you look here, the harder and cheaper the materials become. The audio-system controls and displays are easy to decipher, but the sound from the optional stereo lacks the depth of the other systems. In a world of Google Maps, every new car should have a sharp and clear navigation system. The Alfa's is years behind the Germans', although the map view that makes houses into little Italian villas is a charming reminder of the Alfa's roots.

Another reminder that we were in an Italian car hit us when we briefly warmed up the Giulia using the remote-start feature. After we entered the car and pushed the start button, the Alfa died. A quick restart illuminated the check-engine light and brought up two messages: "Service Electronic Throttle Control" and "Service Engine." The Giulia still drove, but it wouldn't move out of its low-boost advanced-efficiency mode. Fortunately, at the next stop, our always prepared assistant technical editor, David Beard, plugged in his OBD II scanner and cleared the codes. It cured the Alfa, but the fault returned when, in the interest of science, we tried remote-starting the car again. Alfa should include an OBD II scanner as standard equipment, and customers should consider themselves part of the development team.

We are willing to overlook this hiccup, but it's a reminder that Italian cars are part comedy and part tragedy. In the Giulia's case, the comedy far outweighs the tragedy, at least for now.

FINAL RESULTS

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	Maximum points available	ALFA GIULIA QUADRIFOGLIO	MERCEDES-AMG C63 S	BMW M3	CADILLAC ATS-V
RANK		1	2	3	4
VEHICLE					
DRIVER COMFORT	10	9	8	9	9
ERGONOMICS	10	8	8	8	6
REAR-SEAT COMFORT	5	3	3	4	2
REAR-SEAT SPACE*	5	5	5	5	2
TRUNK SPACE*	5	5	5	5	4
FEATURES/AMENITIES*	10	5	10	5	9
FIT AND FINISH	10	8	10	9	7
INTERIOR STYLING	10	9	8	8	6
EXTERIOR STYLING	10	9	8	8	7
REBATES/EXTRAS*	5	0	0	1	1
AS-TESTED PRICE*	20	20	16	18	20
SUBTOTAL	100	81	81	80	73
POWERTRAIN					
1/4-MILE ACCELERATION*	20	20	20	18	19
FLEXIBILITY*	5	4	4	4	4
FUEL ECONOMY*	10	8	8	10	8
ENGINE NVH	10	8	10	7	6
TRANSMISSION	10	10	8	7	7
SUBTOTAL	55	50	50	46	44
CHASSIS					
PERFORMANCE*	20	20	18	19	19
STEERING FEEL	10	9	8	8	9
BRAKE FEEL	10	7	9	8	9
HANDLING	10	10	8	8	9
RIDE	10	10	8	6	9
SUBTOTAL	60	56	51	49	55
EXPERIENCE					
FUN TO DRIVE	25	24	23	21	23
TOTAL	240	211	205	196	195

These objective scores are calculated from the vehicle's dimensions, capacities, rebates and extras, and/or test results.

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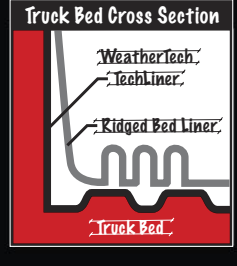

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Perfectly Bad

2017 Chevrolet Camaro ZL1 ▸

Chevrolet sends the Camaro to finishing school and ends up with an impeccably behaved monster.

_by Eric Tingwall _photography by Jeff Stockwell

It's a curious truth of automotive engineering that, in general, the lower the volume target for a new vehicle, the more effort is invested in perfecting it. Engineers seem to sweat the nuances of a Ferrari far more than they do those of a Fiat. The same goes for performance models of mass-produced vehicles. With the tedious stuff already taken care of—say, making the car come together as easily as a SnapTite model on the assembly line—the performance guys are free to spend months toying with bushing stiffness. Unburdened by trivialities such as radio reception or defroster performance, the go-fast department finds time to lap a track for 24 hours.

Such is the back story of the Chevrolet Camaro ZL1. Development engineers fussed over seven iterations of their customized Goodyear Eagle F1 Supercar 3 tires (three iterations are typical in vehicle development). They spent more than a year calibrating the 10-speed automatic transmission. And they made six separate trips to the Nürburgring in order to fine-tune the car, with the eventual payoff being a 7:29.60 lap, almost 12 seconds faster than its predecessor.

That exhaustive development was applied to some of the most astonishing hardware extant. Its magnetorheological dampers take their cues from sensors that read the road 1000 times per second; an electronically controlled limited-slip differential shuffles torque between the rear wheels with computer precision; and a wet-sump variant of the LT4 supercharged 6.2-liter V-8 delivers incredible thrust. Imagine a Dodge Challenger SRT Hellcat that can corner, a Ford Mustang Shelby GT350 with an additional 124 horsepower, and a BMW M4 with even better steering. The Camaro ZL1 is all of these things and more.

The ZL1's parts list is familiar. Many will think of this car as a Corvette Z06 with four seats, its base price of $63,435 equating to a $17,010 discount over the super-Vette. But the ZL1 is not exactly a Z06, even if bits of it certainly are shared. The ZL1's own contribution to Chevy's arsenal of performance parts is its new 10-speed automatic transmission [see "Explained"]. The standard six-speed manual gearbox, with a well-weighted shifter and clutch pedal, is a much better choice for those who want to choose their own gears, but the auto is a 'box of magic.

It allows a dramatic windup through first, then supplies a progression of rapid-fire rpm rewinds as you rocket to triple-digit speeds, the gearbox racing through upshifts with superbike-like snappiness. In Los Angeles traffic, conversely, the transmission picked through the ratios with virtually imperceptible gearchanges. At any pace, it shifts with minimal torque reduction and never hunts for the right ratio. When you demand thrust, the trans executes a sudden yet smooth downshift without any intermediate steps. Mat the throttle from 60 mph and a flawless tenth-to-third transition wakes the LT4 like a sleeping lion poked with a branding iron.

Consider the ZL1's 50-to-70-mph passing performance, a test we initiate once the transmission has selected its highest ratio as the car lopes along at 50 mph. At 2.1 seconds, the ZL1's surge is just 0.3 second behind that of the 532-hp Tesla Model S P90D, which doesn't need to shift its single-speed gearbox.

Having given it 650 horsepower and 650 pound-feet, the engineers leave it to the driver to exercise the restraint necessary to produce the best acceleration. Despite having launch control, the quickest way to 60 mph requires standing on the brake, then smoothly and slowly rolling into the throttle. The goal is to have the accelerator fully squeezed just as you shift into second. You must shift manually, else the autobox will upshift before the 6500-rpm redline, thinking your slow-moving right foot reflects a lack of commitment. Mastery begets glory. You're moving a mile a minute after 3.4 seconds. The quarter-mile flashes past at 125 mph, just 11.5 seconds after releasing the brake.

Chevy makes only minor adjustments to the transmission calibration as you switch between the ZL1's driving modes. In the sport and track settings, the engine cuts fuel on upshifts for faster gearchanges, which are accompanied by a satisfying *blat*, yet the computer still targets the same shift points. That changes when enthusiastic driving triggers one of three performance algorithms, still in sport or track mode. The first level holds gears when you lift off the throttle and rev-matches on downshifts,

[+] Phenomenal power, Mensa-smart 10-speed automatic, chassis that's at home on any road. [–] Too many ratios for satisfying paddle downshifting. [=] Makes the good old days seem less awesome.

Yes, the Shelby GT500 of a few years back made more than 650 horsepower. But the new ZL1 has a chassis that can actually handle its ridiculous power.

while the most aggressive mode constantly holds the lowest possible gear.

The controller watches throttle and brake inputs and lateral g's to activate performance shifting or to revert to the standard setting after a period of soft-pedaling. The only way to decipher which performance algorithm is active is to study where on the 7500-rpm tachometer the needle is spending its time. It's a slightly strange and opaque way to control the transmission, but it works surprisingly well. All it takes is a single corner of hard driving to trigger the performance shift.

The sheer number of gears removes a lot of the joy from manually paddling through the cogs. Not to mention that downshifts in this mode feel significantly slower and clunkier than when the gearbox is left to its own devices. Engineers did attempt to address the tedium of toggling through six or seven or ten gears by writing code that jumps to the lowest possible gear when you hold the left shift paddle, but we found the system to be wildly inconsistent. Sometimes the downshift was nearly instantaneous. At other times, whole seconds passed before the shift occurred. And sometimes, inexplicably, there was no shift at all, no matter how long we held the paddle.

It might look like a brute, but with an eLSD, communicative steering, and perfectly judged suspension tuning, the ZL1 moves with genuine grace.

The new 10-speed transmission, the addition of the eLSD, and an extra 70 horsepower make this ZL1 both faster and more rewarding than the fifth-generation ZL1. Yet the largest transformation happened when all sixth-generation Camaros moved from GM's Zeta platform to the lighter, more nimble Alpha architecture. That change saves more than 200 pounds compared with the prior ZL1. It's not light, at almost 4000 pounds with the automatic gearbox, but the ZL1 coupe moves with uncanny agility.

Equipped with staggered Goodyears, the ZL1 isn't quite as neutral as the fifth-generation Z/28, nor is it latched to the pavement like that car, which wore 305-section Pirelli P Zero Trofeo R rubber at all four corners. It does, though, circle the skidpad at 1.04 g's and haul its 3933 pounds to a stop from 70 mph in 143 feet, continuing to erase the notion of the American muscle car as a crude, one-trick, straight-line hero. Weighty electrically assisted power steering with a variable-ratio rack bends the car into curves with poise and precision. Understeer is easily abated with clean driving or a quick prod of the throttle, and the suede-wrapped steering wheel communicates the chatter of the front rubber instantly and clearly when the tires start to slide. GM's excellent Performance Traction Management offers five increasingly lenient traction and stability settings to help the driver set a quick and safe lap time, no matter their skill.

A new line-lock feature (yes, the Mustang had it first) clamps down on the front brakes for up to 15 seconds so the driver can warm the rear meats before a drag run or smoke out the crowd at a car show. But really, who needs help spinning the tires with this much torque? The launch-control algorithm now offers both automatic and custom settings. The latter allows the driver to select the launch rpm and the amount of wheelslip, from 5 to 15 percent in half-percent increments.

2017 CHEVROLET CAMARO ZL1

PRICE

AS TESTED **$67,000***
BASE **$63,435**

VEHICLE TYPE: front-engine, rear-wheel-drive, 4-passenger, 2-door coupe
OPTIONS: automatic transmission, $1595; performance data recorder, $1300; navigation, $495; black center stripe, $470
AUDIO SYSTEM: satellite radio; minijack, USB, and Bluetooth-audio inputs; Android Auto and Apple CarPlay interfaces; 9 speakers

ENGINE

supercharged and intercooled V-8, aluminum block and heads
BORE X STROKE ..... 4.06 x 3.62 in, 103.3 x 92.0 mm
DISPLACEMENT ..... 376 cu in, 6162 cc
COMPRESSION RATIO 10.0:1
FUEL DELIVERY SYSTEM: direct injection
SUPERCHARGER ..... Eaton R1740 TVS
MAXIMUM BOOST PRESSURE ..... 9.4 psi
VALVE GEAR: pushrods, 2 valves per cylinder, variable intake- and exhaust-valve timing
REDLINE/FUEL CUTOFF ..... 6500/6600 rpm
POWER ..... **650 hp @ 6400 rpm**
TORQUE ..... **650 lb-ft @ 3600 rpm**

DRIVETRAIN

TRANSMISSION: 10-speed automatic with manual shifting mode
FINAL-DRIVE RATIO ..... 2.85:1, electronically controlled limited-slip

GEAR	RATIO	MPH PER 1000 RPM	MAX SPEED IN GEAR (rpm)
1	4.70	6.0	40 mph (6600)
2	2.99	9.4	62 mph (6600)
3	2.15	13.1	87 mph (6600)
4	1.77	16.0	106 mph (6600)
5	1.52	18.5	122 mph (6600)
6	1.28	21.9	145 mph (6600)
7	1.00	27.5	182 mph (6600)
8	0.85	32.4	195 mph (6025)
9	0.69	40.3	185 mph (4600)
10	0.64	43.4	180 mph (4150)

CHASSIS

unit construction with a rubber-isolated rear subframe
BODY MATERIAL: steel and aluminum stampings

STEERING

rack-and-pinion with variable ratio and variable electric power assist
RATIO 15.0–11.0:1
TURNS LOCK-TO-LOCK 2.3
TURNING CIRCLE CURB-TO-CURB ..... 38.4 ft

SUSPENSION

F: ind, struts located by 1 diagonal and 1 lateral link, coil springs, 3-position electronically controlled magnetorheological dampers, anti-roll bar
R: ind; 2 diagonal links, 2 lateral links, and a toe-control link per side; coil springs; 3-position electronically controlled magnetorheological dampers; anti-roll bar

BRAKES

F: 15.4 x 1.4-in vented disc, 6-piston fixed caliper
R: 14.4 x 1.1-in vented disc, 4-piston fixed caliper
STABILITY CONTROL ..... fully defeatable, traction off, competition mode, launch control

WHEELS AND TIRES

WHEEL SIZE ..... **F:** 10.0 x 20 in **R:** 11.0 x 20 in
WHEEL CONSTRUCTION ..... forged aluminum
TIRES ..... Goodyear Eagle F1 Supercar 3
F: 285/30ZR-20 (95Y) **R:** 305/30ZR-20 (99Y)

EXTERIOR DIMENSIONS

WHEELBASE ..... 110.7 in
LENGTH ..... 188.3 in
WIDTH ..... 74.7 in
HEIGHT ..... 52.4 in
FRONT TRACK ..... 63.4 in
REAR TRACK ..... 62.6 in
GROUND CLEARANCE ..... 4.0 in

INTERIOR DIMENSIONS

SAE VOLUME ..... **F:** 54 cu ft **R:** 31 cu ft
TRUNK ..... 9 cu ft

CAR AND DRIVER TEST RESULTS

ACCELERATION

ZERO TO	SECONDS
30 MPH	1.5
40 MPH	2.1
50 MPH	2.7
60 MPH	**3.4**
70 MPH	4.3
80 MPH	5.2
90 MPH	6.2
100 MPH	**7.4**
110 MPH	8.8
120 MPH	10.4
130 MPH	12.4
140 MPH	14.9
150 MPH	18.4

*C/D *est.*

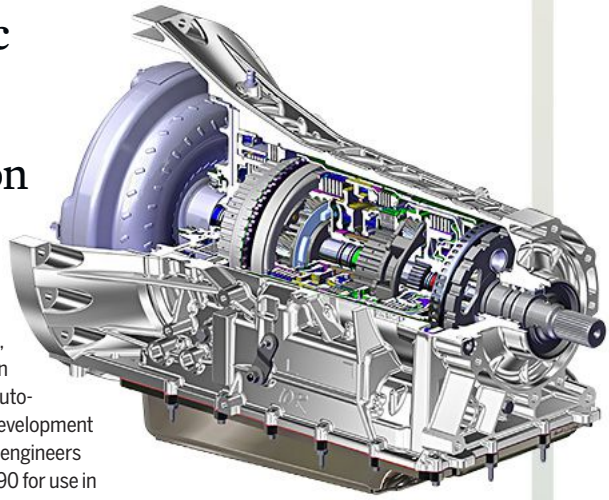
tested by ERIC TINGWALL *in California City, CA*

The team that built the ZL1 pitches the car as equally adept at running quarter-mile drags, lapping Virginia International Raceway, or writhing along the Angeles Crest Highway. It's certainly competent at any of those activities, but we think it's truly exceptional at the last one, streaking down a great road and plastering a grin on your face. Strapped into the deeply bolstered Recaros by red seatbelts (standard with select exterior colors), we hammered the ZL1 over the highway through the San Gabriel Mountains north of Los Angeles, confident in its firm brake pedal and natural steering, the trans automatically holding the lowest gear, and the engine blasting anger through the valleys. Few things have made us happier this year.

We weren't offered a chance to drive the ZL1 convertible, so we can't say if Chevy has done anything to stiffen that rolling tub of Jell-O. The coupe, however, has no trouble managing the engine's grunt, the road's imperfections, and the considerable cornering forces the ZL1 can muster.

With the Camaro ZL1, Chevrolet mixes its most raucous, most capable hardware into a monster of a car at a bargain price. More tire and less weight could turn it into a true track rat, but it's a car that you can live with every day and hustle across any piece of pavement, and we wouldn't change a thing. The ZL1 is even greater than the sum of its special parts.

Explained: Hydra-Matic 10R90 Automatic Transmission



The 10-speed automatics in the Ford F-150 Raptor and the Camaro ZL1 originate from the same base gearbox, the product of a collaboration between the two American automakers. While Ford led the development of the 10R transmission, GM engineers refined the Hydra-Matic 10R90 for use in the company's high-output powertrains. Hydra-Matic–specific pieces include the torque converter, clutch components, planetary gear carriers, and bearing supports, all uprated to cope with the LT4 V-8's 650 pound-feet of torque.

All 10R transmissions get their 10 ratios from four planetary gearsets selectively controlled with six clutches—four that rotate and two that act as brakes. The transmission case slips into the same space as GM's longitudinal eight-speed, which fits into the same space as the six-speed before it.

You might expect the industry's first 10-speed transmission to boast a gaping overall ratio spread, but the 10R's 7.38:1 range is far from the widest in the business. Among longitudinal automatic transmissions, that spread is topped by ZF's second-generation eight-speed 8HP, and both seven- and eight-speed versions of Porsche's PDK for front-engine vehicles, the latter of which has a yawning 11.26:1 spread.

Engineers say there'd be little benefit to stretching the ratio spread given the 10R's intended applications. The ZL1 lights up its tires at less than full throttle in first gear, and the LT4 turns over at less than 1900 rpm in 10th gear at 80 mph. Instead, the 10R packs its ratios closer together, with upshifts averaging a 19 percent drop in rpm versus 29 percent in the eight-cog PDK. That keeps the engine closer to its power peak throughout full-throttle acceleration runs, and this keeps us happy. —*ET*

ROLLING START, 5–60 MPH 3.9
TOP GEAR, 30–50 MPH 1.8
TOP GEAR, 50–70 MPH 2.1
1/4-MILE ..... **11.5 sec @ 125 mph**
TOP SPEED ..... 195 mph (drag ltd, *C/D* est)

HANDLING
ROADHOLDING, 300-FT-DIA SKIDPAD ..... **1.04 g**
UNDERSTEER ..... Moderate

BRAKING, 70-TO-ZERO MPH
SHORTEST STOP ..... **143 ft**
LONGEST STOP ..... 162 ft
FADE RATING ..... None

WEIGHT
CURB ..... **3933 lb**
PER HORSEPOWER ..... 6.1 lb
DISTRIBUTION ..... **F:** 54.5% **R:** 45.5%
TOWING CAPACITY ..... 0 lb

FUEL
CAPACITY ..... 19.0 gal
OCTANE ..... 91 (required)
EPA COMBINED/CITY/HWY ..... 18/15/22 mpg (*C/D* est)
***C/D* OBSERVED** ..... **13 mpg**

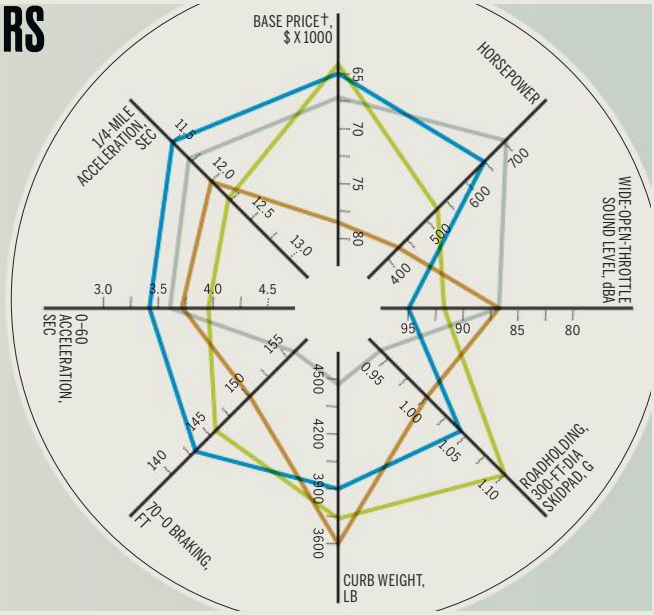
INTERIOR SOUND LEVEL
IDLE ..... 46 dBA
FULL THROTTLE ..... 95 dBA
70-MPH CRUISING ..... 69 dBA

COMPETITORS

Who ever said America wasn't great?
—

BMW M4
3.0-L I-6, 7-SP AUTO
CHEVROLET CAMARO ZL1
6.2-L V-8, 10-SP AUTO
DODGE CHALLENGER SRT HELLCAT
6.2-L V-8, 8-SP AUTO
FORD MUSTANG SHELBY GT350R
5.2-L V-8, 6-SP MAN

†Includes performance-enhancing options.



Shell V-Power NiTRO+ Premium Gasoline
The Official Fuel of CAR AND DRIVER

Racing's Little

We peek inside the black boxes of racing's newest technologies to find out what's in it for us.

by Aaron Robinson

WE STILL THINK OF RACING as the pointy spear of automotive development, where new ideas are tested in a freewheeling, cost-no-object arms race. It's a romantic notion, though, and somewhat outdated, as racing isn't what it used to be. The age of rulebook tyranny has descended, in which the goals of improved safety and reduced cost take precedence over ever-higher speeds. Indeed, today's rulemakers spend more time trying to slow cars down than speed them up, and they exert their dominion with picayune chassis and engine guidelines. The 2016 FIA technical regulations governing Formula 1 cars run to 90 pages; regulation 5.11.1 limits the number of spark-plug firings per combustion event to five, et cetera and so forth. The series then forces uniform electronic controllers onto the teams as embedded spies to ensure compliance. Electronic stability controls and active aerodynamics, now common on road cars, are almost universally banned in racing, meaning a Porsche 918 Spyder is closer to technology's sharp end than most race cars.

Considering that the field of the dazzling 1967 Indy 500 featured everything from pushrod engines to overhead-cam V-8s to one very fast turbine, today's racing, by comparison, is tied to the technological post. And yet, the racing community is still pushing, and ordinary drivers will eventually benefit. Carbon fiber came from aerospace, went into race cars, and can now be found in BMW road cars, among others. Likewise, battery and power-control technology being explored in racing will have direct application to the coming wave of electric vehicles, and tires never stop evolving. Today's pet racing technologies might not be as sexy as a turbine car fielded by guys wearing STP pajamas, but they may ultimately prove more relevant to the cars we buy in 20 years.

Here are some examples:

Formula E batteries

Electric racing suffers from a somewhat amusing handicap: Formula E cars lack the endurance to run a full race, so the drivers must stop halfway through and hop into fresh cars with topped-up 28-kWh batteries. All that may go away by 2018, however, as the next generation of lithium-ion racing packs rolls out.

photograph by CHARLIE MAGEE

Secrets

UNBOXING

1 DC high-voltage output to the inverter

2 Arming plugs, which are pulled out to disarm the battery to make it safe for travel and service and are pushed in to arm the battery for racing

3 Electrical connections for the data logger and battery-management system

4 In and out fittings for coolant flow to the battery's radiator

SOME (NEW) BATTERIES REQUIRED

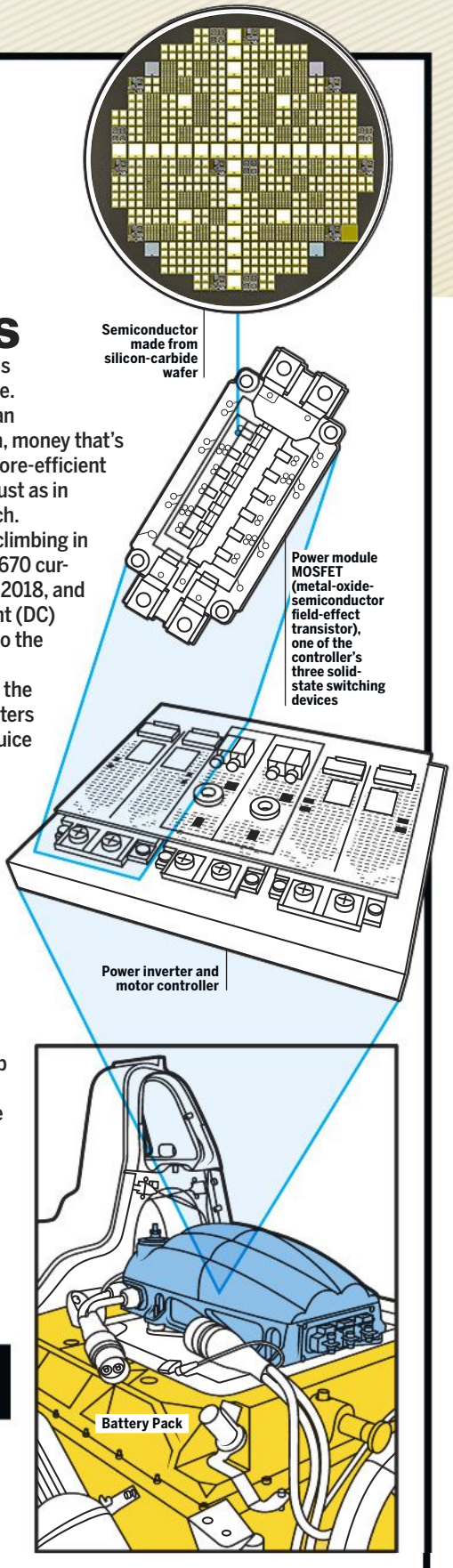
FORMULA E'S NEXT-GEN BATTERY

Supplier McLaren Applied Technologies, an offshoot of the road- and racing-car business, is mum on the details of the changes to the cells and the cooling strategy, which is vital to holding down the pack's temperature and making the batteries last. Anything above a mere 144 degrees Fahrenheit would cook the current batteries. But it's known that capacity will roughly double in McLaren's new packs to 54 kWh, and it's certain that voltage will go up to somewhere between 800 and 1000 volts. Higher voltage means lower amperage for the same power, allowing for thinner, lighter wiring and, with an optimized cooling system, less heat, which allows heavier-duty cycles with faster recharging. Higher voltages create an upward spiral of benefits that the automotive industry wants to jump on for production electric vehicles.

SICK SIC IS SLICK

Silicon-carbide power inverters

Increasingly, electricity is the race fuel of the future. Formula E recently saw an influx of automaker cash, money that's being used to develop more-efficient electric-drive systems, just as in electric road-car research. Battery-pack voltage is climbing in Formula E, from around 670 currently to at least 800 by 2018, and turning the direct-current (DC) flow from the battery into the three-phase alternating current (AC) required by the motor takes power inverters that can handle a lot of juice without getting hot, as heat creates power-sapping resistance. These solid-state, high-speed switching mechanisms—basically semiconductors that have two terminals in from the battery and three terminals out to the motor—have to switch up to 40,000 times per second to keep up with the demands of Formula E's furious drive motors. Use of silicon carbide in power inverters is the breakthrough. Formed at temperatures about 3000 degrees Fahrenheit, SiC semiconductors only 0.2 inch thick can handle hundreds of amps in a power inverter with 95 percent efficiency. The downside is cost; one Formula E team said its last chipset cost $18,000, so it may be a while before we see this technology in street electrics.


Semiconductor made from silicon-carbide wafer
Power module MOSFET (metal-oxide-semiconductor field-effect transistor), one of the controller's three solid-state switching devices
Power inverter and motor controller
Battery Pack

Hz so good

The frequency at which certain objects switch, spin, sense, and search, in Hertz, or cycles per second:

- **60** – U.S. electric grid alternating current
- **148** – Ferrari F12tdf crankshaft rotation at redline
- **200** – Hummingbird wingbeat
- **1000** – Sensing frequency for magnetorheological dampers
- **3667** – Infiniti V-6 turbocharger peak rotation
- **7667** – Dental drill peak rotation
- **40,000** – Silicon-carbide power inverter switching
- **63,000** – Google searches

Racing's offspring:

- **Formula 1's carbon-carbon brake** tech descended to production cars as carbon-ceramic brakes on mega-exotics such as the Ferrari Enzo in 2002. Carbon-ceramics are now a common option on performance cars, from the Chevy Corvette to the BMW M3/M4.

- Ferrari introduced **paddle shifting** to F1 in 1989, and by 1997 a street version was in production with the Ferrari 355 F1. Since then, single-clutch automated gearboxes have given way to smoother and quicker dual-clutch transmissions, and nearly every car, from the Bentley Continental to the Honda Civic hatch, has sprouted shift paddles.

- Modern F1 **steering wheels** are renowned for cramming together knobs and buttons. Such driver-changeable modes have migrated to road cars, with systems such as GM's Performance Traction Management giving Corvette drivers, for example, a wide range of stability, traction, and suspension modes to choose from. We can also thank racing for the development of launch control—even though it's outwardly banned in most series nowadays.

- Computer airflow simulation combined with actual wind-tunnel work is what gives some racers the edge in tightly regulated series. All this intense **aerodynamic development** in recent years has paid automakers real dividends, especially those trying to cut drag or induce downforce in high-performance models. Many production cars, such as the Acura NSX, have sprouted flying buttresses or grown under-car air tunnels.

- **Carbon fiber** became the standard material for F1 tubs in the mid-1980s and eventually filtered down. Its appeal to the wider auto industry has been obvious: high strength and low weight. Now that billions have been spent on its development, we see ever wider deployment, both as nonwoven molded composites for structural and closure panels and as woven parts for roof panels and other exterior pieces.

illustrations by CHRIS PHILPOT

EFFICIENT RUBBER

Michelin Pilot Sport EV2

Tire Basics 101 teaches that as grip goes up, so does rolling resistance, which negatively affects fuel economy. Racers, however, like car companies, want more grip with less resistance. Michelin, the supplier of the Pilot Sport EV to Formula E, claims to have delivered just that, reformulating the grooved spec tire with new compounds and construction that should increase corner speed while reducing rolling resistance. How? Michelin won't say, exactly, but hints can be found in the new Pilot Sport 4 S, announced last fall as a replacement for the Pilot Super Sport. The 4 S shares an almost identical tread pattern with the racing Sport EV2, which is unlike most racing tires in fitting an 18-inch rim and otherwise having road-car dimensions. A new type of construction strategically places the grippiest rubber compound only where it's needed, and the reinforcing strands of belt material preserve the shape of the tire so that those compounds do the bulk of the cornering work while standing by on straights. For greater endurance, the design also better distributes over the whole tire the heat generated by cornering loads. That's about all we can say, since at Michelin, the secret sauce is so secret that the company no longer patents its best discoveries.

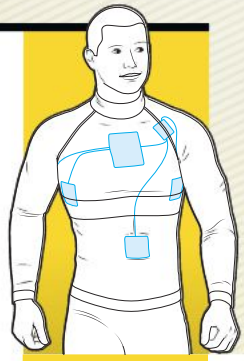
MOST IMPROVED RACER
The second-generation Michelin Pilot Sport EV2 is vastly improved over the Pilot Sport EV from the 2014–15 season.

- **–11 pounds (set of four)**
- **–16% rolling resistance**
- **+1.2 miles of range**

SARTORIAL SENSING

HITOE SENSOR SHIRT

With most big-time series now regulating the amount of testing, teams use every on-track moment as an opportunity to collect data. Even the driver has now become a data point. A Japanese electronics and textile firm jointly developed Hitoe, or "one layer," a flexible, breathable material in which the fabric nanofibers are coated with a conductive polymer able to transmit electrical signals. A fireproof version has been tested in IndyCar and was able, despite g-loadings and copious perspiration, to transmit data to the team on the driver's heart rate and regularity. The shirt also delivered a continuous electromyogram, which measures the neurological activation of the muscles. The data showed that, at times, a driver is working about as hard as a sprinting runner, information that could help drivers extract even more performance from their g-loaded bodies. With wider tires coming to Formula 1 in 2017, the g squeeze is on more than ever. Such clothing may someday tell your Toyota Camry about your fading pulse rate and drowsy eyes and prompt it to act.



Tony Kanaan debuted the Hitoe technology during the 2016 IndyCar Series.

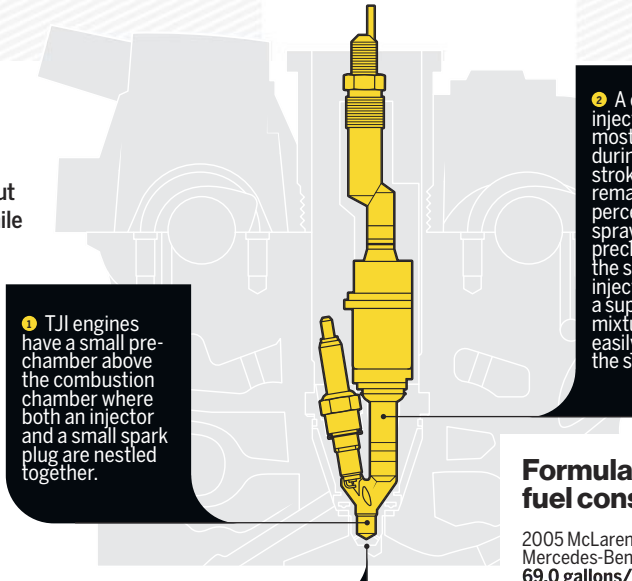
Smart clothing:

- The **Heddoko athletics shirt's** motion-capture sensors create a 3-D model of your movements on your smartphone so you can run or work smarter or strike the perfect Warrior II pose.
- Ralph Lauren makes smart clothes fashionable with the **PoloTech Shirt**, the interwoven silver fibers of which report biometric data to your iPhone or Apple Watch to track calorie burns and workout intensity.
- **The Gymi Smart Shirt** from Australia has sensors that can track your reps and sets for the perfect pump.

FIRE IN THE HOLES

Turbulent Jet Ignition

Exactly what goes on under the carbon-fiber shell of a Formula 1 car is a matter of guesswork for observers, but they should know that it's all about saving fuel. For a while last season, rumors persisted that Mercedes AMG Petronas, among others, was using homogeneous-charge compression ignition, or, essentially, combusting gasoline as if it were diesel under certain conditions and as a spark-ignited engine the rest of the time. Then it emerged that the team was actually onto something new, called Turbulent Jet Ignition, which extracts more energy from the fuel similar to Honda's old Compound Vortex Controlled Combustion from the 1970s. For now, this is racing-only tech, since at the much lower speeds and power loads that road cars run, the combustion isn't stable.



❶ TJI engines have a small prechamber above the combustion chamber where both an injector and a small spark plug are nestled together.

❷ A conventional injector sprays most of the fuel during the intake stroke. The remaining 5 percent or so is sprayed into the prechamber by the secondary injector, yielding a super-rich mixture that's easily ignited by the spark plug.

❸ Burning fuel exiting the prechamber through four to eight tiny orifices initiates combustion of the main fuel-air charge. The resulting flame front spreads quickly through the combustion chamber, allowing a much leaner overall mixture and improved fuel efficiency.

Formula 1 peak fuel consumption:

2005 McLaren MP4-20
Mercedes-Benz FO 110 R V-10
69.0 gallons/hour

2016 AMG Petronas F1 W07
PU106C V-6 hybrid
35.6 gallons/hour

Materials to know

What comes after carbon fiber? Nobody is sure, but racers are looking at some new materials such as graphene, a latticework of carbon atoms that is both immensely strong and also highly electrically conductive, making it ideal for battery terminals, semiconductors, and possibly structural elements. Also, advanced electric motors are increasingly dependent on hyper-exotic steel alloys that are both strong and highly magnetic. Produced in sheets no thicker than tissue paper, the steel gets its required shape by being stamped from the sheet and then layered up by the thousands into ultra-efficient rotors and stators that generate more torque for a given current. The costs are high, however; one Formula E team says it takes about 100 pounds of such steel–at $140 per pound–to make each motor.

—

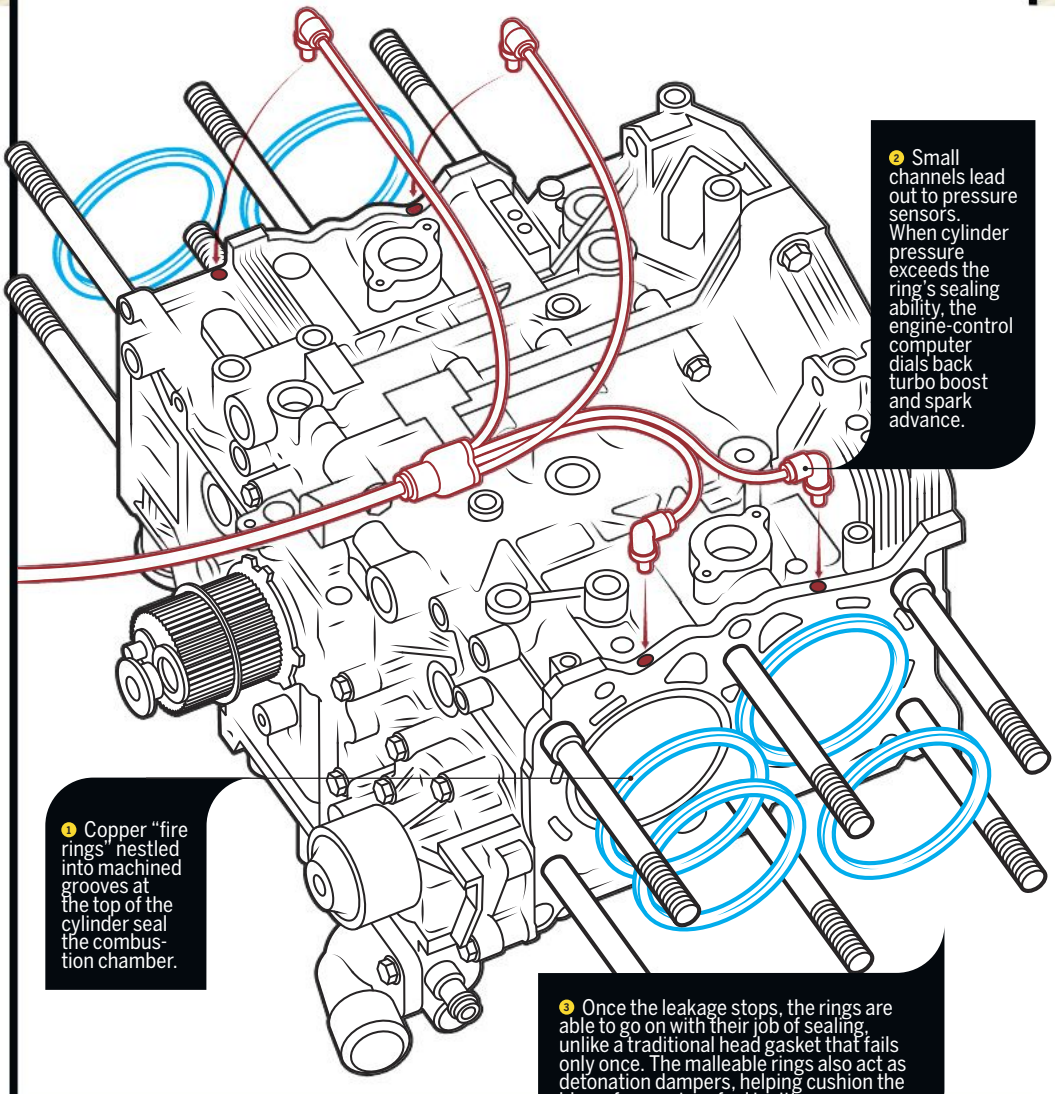
Candid cameras

NASCAR isn't known for tech innovation, but its new Pit Road Officiating (PRO) video system substitutes a crowd of pit-lane officials with 40 to 50 cameras, depending on the venue, which monitor the pits during a race. The video feeds to a single trailer where computers can detect potential rule violations and flag them for closer examination by race officials. Instead of dozens of officials risking their safety in the pits, eight stewards in the trailer plus some sophisticated software handle the officiating in a fast-moving sport where there are no timeouts for review.

OUT OF OUR HEADS

Prodrive head-gasket-less engine

We all know that head gaskets seal the cylinders of an engine block where it meets the head. But once the gasket is blown, it's game over. England's Prodrive, which builds and fields rally cars and built a special Subaru boxer-four for an Isle of Man TT time-trial car, wondered if it could create a smart head gasket that recognized imminent failure and was able to tell the computer to dial back the boost and spark advance accordingly. Its solution is an engine with no head gasket at all. The idea may someday find its way into mass production as automakers try to extract ever more performance from smaller turbocharged engines.



❶ Copper "fire rings" nestled into machined grooves at the top of the cylinder seal the combustion chamber.

❷ Small channels lead out to pressure sensors. When cylinder pressure exceeds the ring's sealing ability, the engine-control computer dials back turbo boost and spark advance.

❸ Once the leakage stops, the rings are able to go on with their job of sealing, unlike a traditional head gasket that fails only once. The malleable rings also act as detonation dampers, helping cushion the blow of premature fuel ignition.

SUPERCOLLIDER

PORSCHE 911 RSR

Last year at Le Mans, Porsche could only stand by helplessly as Ford invaded its turf and cleaned up in the production-based GTE Pro class with a, ahem, barely legal purpose-built racer. Well, Porsche ain't taking it lying down. It has unleashed the 911 RSR, which at this point it won't even talk about. Why are we talking about it? Because it looks amazing in pictures, and it's almost as if it's powered by half a Porsche 917, with its naturally aspirated mid-mounted flat-six. Also, it has a radar-based anti-collision system that should help the driver avoid nasty interclass accidents, a common phenomenon at Le Mans. The 911 RSR takes advantage of radar, video, and computer-analysis tech that is increasingly deployed in road cars—there as stepping stones to future autonomy, here as a way to avoid becoming a bug splat on an LMP's windshield.

Electrifying racing

Highlights in the brief history of modern electric racing

• **1998:** Panoz Esperante GTR-1 Q9 electric hybrid, nicknamed "Sparky," finishes second in class and 12th overall at the Petit Le Mans.

• **2006:** FIA chief Max Mosley says F1 cars should adopt regenerative-braking systems.

• **2007:** Toyota wins the Tokachi 24 Hours with its Supra HV-R hybrid, which uses in-wheel electric motors and supercapacitors.

• **2008:** Peugeot shows a hybrid-diesel Le Mans prototype, the 908 HY, but abandons plans to campaign it in the 2009 season.

• **2009:** FIA permits use of kinetic energy recovery systems (KERS) in Formula 1. It recovers braking energy and returns it as an 80-hp boost. Some teams use it, others don't.

• **2011:** After 2010, in which no F1 teams used KERS, rule changes make it more attractive, and most teams adopt it this time.

• **2011:** New rules at Le Mans open the door to hybrids.

▲ **2012:** Audi and Toyota become the first big factory teams to field hybrids at Le Mans. Today, hybrids dominate the top LMP1 class.

• **2014:** First Formula E race held in Beijing. Entrants use a spec Dallara chassis and common 28-kWh battery and motor based on components from the McLaren P1 road car.

• **2015:** Formula E rules open up, allowing teams to develop their own powertrains.

• **2016:** Audi cancels its Le Mans program, moves to Formula E. Likewise, BMW jumps in and ***Jaguar announces I-type Formula E racer.***

ONE BLACK BOX TO RULE THEM ALL

TAG-320 controller

A glimpse into one way that automotive electrical systems will change is provided by the TAG-320, a three-pound electronic megabrain that is required equipment in Formula 1, with similar controllers required by IndyCar and NASCAR. In 2008, F1 helped initiate the wave of race series moving to spec controllers by mandating that all teams use a common computer, then the TAG-320's precursor, the TAG-310B. Made in England (where else?) by McLaren Applied Technologies, the TAG takes its name from Techniques d'Avant Garde, the meaning of the acronym in TAG Group S.A., a private investment firm long associated with McLaren and racing. The TAG box does what many automakers are looking to do in the future: integrate the proliferating number of black boxes in a car into as few units as possible to save weight, packaging space, and cost. Before the first TAGs arrived, F1 teams had to spend time integrating powertrain controllers from their engine suppliers with the body controllers they purchased separately, exactly what automakers do now when they try to get one supplier's seat-control module to talk to the touchscreen controller from another supplier. The TAG, and especially the newer 320 that arrived in 2013, which must operate an F1 car's enormously complex 1.6-liter turbo V-6 with its twin energy-recovery units, is powerful enough to run everything. The company lists its processing speed as "over 4000 MIPS" or millions of instructions per second. Not as impressive as, say, the 64-bit Apple A10 processor in an iPhone 7, but the 32-bit TAG-320 will crunch through somewhere north of 400 million calculations between now and the end of this sentence. Why is such computing power important? An F1 gearchange takes 0.001 second, says McLaren Applied's Tim Strafford, and to do it right, the computer must know the exact position of every rotating component in the drivetrain. "Get it wrong and it's catastrophic failure for the gearbox," he says. Why is the TAG-320 shaped like half a stop sign? Because its first user, McLaren Mercedes, wanted it to fit on the floor under the driver's thighs, and the shape stuck.

TAG Team:

TAG-320
TAG-310B

• **Processors**
6
4

• **Processing Speed**
4000 MIPS
1700 MIPS

• **Logging Memory**
8 GB
1 GB

• **Ethernet Communication Speed**
1 Gb
100 Mb

E-FUTURE **"The car industry is undoubtedly heading in one direction. Automakers are choosing different alleys to get there, but it's still a common direction toward electric technology. . . . But just as it is for the road-car industry, it is hard to guess the timeline in motorsport, which will take longer to adapt. ¶ Looking at Norway's stance on sales of petrol cars from 2025 as one example [the country has proposed a ban on internal-combustion cars by then], government legislation and business in general will play a major role to create the framework for this shift to happen sooner rather than later. And motorsport will gradually and necessarily follow thereafter."** *—Renato Bisignani, director of communications, Formula E*

HOT VS. CHEESY

WE PIT THE DOMINO'S DXP AGAINST THE WORLD'S LAMEST MITSUBISHI ECLIPSE IN A BATTLE FOR PIE-DELIVERY SUPREMACY.

BY JOHN PEARLEY HUFFMAN

When we heard that Domino's Pizza was claiming its new DXP is "the ultimate pizza delivery vehicle," we took it as a call to action. Those pizza suits in their fancy office park on the other side of our very own Ann Arbor might know a thing or two about tomato sauce, but making baseless claims about automobiles is encroaching dangerously on our turf. So we called Domino's corporate with an ultimatum: We'd stay out of the pizza business if Domino's would let us test the DXP, preferably one that's delivered full of fresh product. Nothing short of a scientific evaluation would do.

The DXP appears to be unprecedented. If there's been a sort-of-purpose-built pizza car deployed by another pizza megacorporation, *C/D*'s intelligence network is unaware of it. So, in order to stage a proper comparison test, we needed a "typical" pizza-delivery car. Working from lazy stereotypes and lurid high-school assumptions borne out of watching bad 1980s VHS porn ("Ma'am, did you order the large pepperoni?"), we set off to acquire a late-model Pontiac Firebird. "Not a Trans Am," explained features editor Jeff Sabatini, himself a former pizza-delivery driver, "because that's actually cool. A ratty fourth-gen V-6 Firebird, however, would be the perfect car to embody all the desperation and economic marginalization of the average delivery driver, while also reflecting his unreasonable aspiration to something greater."

Cheap Firebirds may grow under trees in the Midwest, but in my neighborhood of Santa Barbara, California, they are in

illustration by SEAN McCABE, *photography by* SCOTT G. TOEPFER

WARMING
MAXIMUM CAPACITY
20 PIZZAS

Left: The broken glass came courtesy of the world's dumbest stereo-system thief. Right: Passenger seat for the world's most oddly shaped buttocks.

short supply. Or, at least, their owners have yet to discover Craigslist. With a deadline fast approaching and no suitable car to use as our control, desperation drove me into Buellton, a nearby one-horse town (and that horse has pinkeye). Along Buellton's Avenue of the Flags, which is barely an avenue and where there are no flags, are tow shops that retrieve derelicts off the highway. And in front of one was an impounded 2001 Mitsubishi Eclipse on pockmarked wheels shedding its custom flame paint job. Faded glory, bitter automotive betrayal, and a sketchy employment history, all embodied in one black heap. It was perfect, and, according to the tail badge, it was a GT-R. I offered $1300 to the shop that had impounded it, and the offer was immediately accepted, meaning that I overpaid.

Domino's isn't trying to hide the DXP's origins. It's a Korean-built Chevrolet Spark that's been transmogrified by Roush Industries in Livonia, Michigan, into an oh-so-adorable mishmash of Good Humor ice-cream truck and Oscar Mayer Wienermobile, all wrapped in self-aware Noid-inspired vinyl graphics. At least it's better than the mopeds given to pizza-delivery dudes in Korea, and its "Warming Oven" almost nearly works.

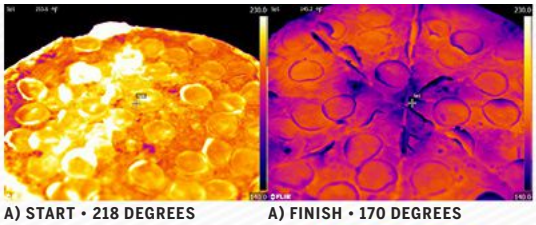
First shown at a 2014 franchisee convention in Las Vegas, the DXP arrives at an inflection point in the history of pizza delivery. According to the 2017 Pizza Power Report issued by *PMQ Pizza Magazine*, pizza sales in the United States through September 2016 reached just over $44 billion. Large chains, such as delivery-obsessed Domino's, outsell independent pizzerias, even as mom-and-pop shops outnumber the corporate stores. Presumably internet ordering systems that store credit-card and delivery-address data will only increase the chains' advantage, as *PMQ* says online ordering will soon overtake phone ordering. Customers are hardly even aware they're spending real money on pizza as it magically shows up a few minutes after they tap an app. Delivery—by car, Skynet-loyal drone, or express zombie-gram—is America's pizza present and future.

Alas, Domino's had plenty of legalese to keep *C/D* from actually delivering its pizzas. We could drive the DXP, but not make actual deliveries. So we drove it, but we also followed as Joe Hayes, a trained pizza professional, delivered pies around the student ghetto of Isla Vista near the University of California, Santa Barbara. There's only one seat in the DXP anyhow. It sort of worked out.

Incidentally, again according to *PMQ Pizza Magazine*, 54 percent of millennials have posted photos of their pizza to social media. Go figure.

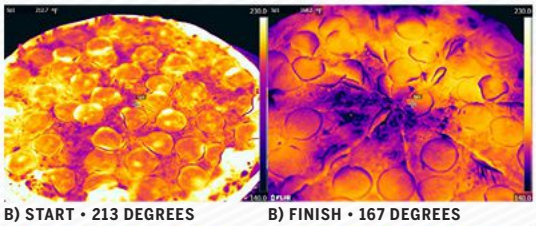
2. MITSUBISHI ECLIPSE GT-R

When we bought this unwanted car, the flat-spotted tires rode like rocks. The booming aftermarket stereo would turn on



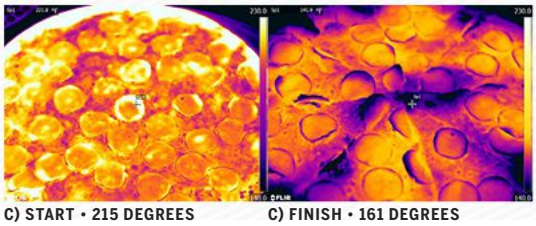
A) START • 218 DEGREES

A) FINISH • 170 DEGREES



B) START • 213 DEGREES

B) FINISH • 167 DEGREES



C) START • 215 DEGREES

C) FINISH • 161 DEGREES

HOT BOX, HOT BAG, HOT CAR

C/D **borrowed a T640 thermal imaging camera from Flir Systems to record the temperatures of three fresh-from-the-oven medium pepperoni pizzas. Pizza A was placed in a Domino's corrugated cardboard box plus the "Heatwave" insulated bag normally used to deliver all Domino's pizzas. Pizza B was similarly bundled but also placed in the Warming Oven of the Domino's DXP for delivery. And finally, Pizza C was only put in the box. After an eight-minute trip to franchisee Mark Talarico's house a mile and a half away, we photographed them again.**

So, which one best retained its cheesy, bubbly, toasty deliciousness? Without either the bag or oven around it, Pizza C lost heat rapidly, dropping from a center average temperature of 215 degrees out of the oven down to 161 degrees at delivery. The remaining heat was well distributed around the pie, with the coldest spots at its center where the air gaps from being sliced facilitated cooling.

The bagged Pizza A dropped from 218 degrees at the oven down to 170 degrees at delivery. However, across the pie face the temperature was higher and more consistent, with a cold spot at the center where, we speculate, the pizza came in contact with the top of the box, dissipating some heat.

But it was Pizza B, the one that took its trip in the DXP, that lost the least heat. At 213 degrees, it came out of the oven with the coolest center average temperature, but at a sizzling 167 degrees at delivery, it saw the smallest temperature drop. We suspect that the heating pad in the DXP's Warming Oven's bottom isn't that effective. But the plastic box itself helps retain heat better than just the thermal bag. So if you want your pizza piping hot, ask for delivery in a DXP. ***—JPH***

randomly and issue static at full volume. The exhaust droned, the peeling window tint became a reality-distortion field, and the battery died. And an OBD II fault made it temporarily impossible to pass California's smog check and get our Eclipse GT-R registered. Then some moron broke into it, shattering the right-side window and stealing the worthless sound equipment, including the massive subwoofer box filling the rear cargo area. So we now have a $700 car, a hole in the dash, and two new Santa Barbara cop friends.

2001 Mitsubishi Eclipse GT-R [+] Cheap. So very, very cheap. [–] Tough to register, hole in dash, broken glass on passenger's side, droning exhaust, embarrassing paint. [=] Only $1300 (or so) and it can go anywhere a Ferrari can.

For safety during delivery duty, we bolted on a set of pretty Moda MD22 18-inch wheels inside 225/40ZR-18 Kumho Ecsta 4X II tires. That's $953 through Tire Rack, and utterly transformative in terms of the Eclipse's driving dynamics. Suddenly it felt like a real car that could, like, turn and stuff. We also replaced the passenger's-side window with $13 worth of plastic sheeting and duct tape from Home Depot.

"There's no way Domino's would let you deliver pizza in that thing," declared Mark Talarico, the Domino's franchise owner in Isla Vista. "It's way too dangerous. You can't see out of it." He's right.

In 2001, Mitsu rated the 2.4-liter four in this Eclipse at a forgettable 140 horsepower and backed it with a four-speed automatic transmission. Now, 16 years later, it reaches 60 mph in 10.6 seconds and runs the quarter-mile in 18.1 seconds at 76 mph. That's awful, and yet better than the DXP. But it took a scandalous, fast-fading 246 feet to stop from 70 mph. And that's despite the rear drums and front brake calipers having been painted performance-enhancing red.

It rained on the delivery night, and that kept the passenger door taped shut. Meanwhile Domino's intrepid Hayes was practically guillotined pulling a pizza out of the cargo hold, because the rear hatch's hydraulic struts were blown. The 40-foot turning circle made U-turns difficult, it was nigh impossible to read addresses

You could say the Eclipse GT-R has blown hatch struts. But we prefer to think of it as having a self-closing feature. It can be held up with an "arm."

	2015 DOMINO'S DXP	2001 MITSUBISHI ECLIPSE GT-R
PRICE AS TESTED	$25,750*	$2560
BASE PRICE	$25,750*	$1300
DIMENSIONS		
LENGTH	144.7 in	175.4 in
WIDTH	62.9 in	68.9 in
HEIGHT	72.5 in*	51.6 in
WHEELBASE	93.5 in	100.8 in
FRONT TRACK	55.7 in	59.4 in
REAR TRACK	55.5 in	59.4 in
INTERIOR VOLUME	**F:** 24 cu ft	**F: 47 cu ft** **R: 31 cu ft**
CARGO VOLUME	**55 cu ft**	17 cu ft
POWERTRAIN		
ENGINE	DOHC 16-valve inline-4 76 cu in (1249 cc)	SOHC 16-valve inline-4 143 cu in (2351 cc)
POWER HP @ RPM	84 @ 6400	**140** @ 5500
TORQUE LB-FT @ RPM	83 @ 4200	**155** @ 4000
REDLINE/FUEL CUTOFF	N/A/6850 rpm	6000/6200 rpm
LB PER HP	27.9	**22.2**
DRIVELINE		
TRANSMISSION	CVT	4-speed automatic
DRIVEN WHEELS	front	front
GEAR RATIO:1/ MPH PER 1000 RPM/ MAX MPH	**Lowest:** 4.00/4.4/30 **Highest:** 0.55/32.0/85	❶ 2.84/5.9/37 ❷ 1.53/11.0/68 ❸ 1.00/16.8/104 ❹ 0.71/23.7/120
AXLE RATIO:1	3.75	4.04
CHASSIS		
SUSPENSION	**F:** struts, coil springs, anti-roll bar **R:** torsion beam, coil springs	**F:** struts, coil springs, anti-roll bar **R:** multilink, coil springs, anti-roll bar
BRAKES	**F:** 10.1-inch vented disc **R:** 7.9-inch drum	**F:** 10.1-inch vented disc **R:** 9.0-inch drum
STABILITY CONTROL	fully defeatable, traction off	none
TIRES	Goodyear Integrity 185/55R-15 82T M+S	Kumho Ecsta 4X II 225/40ZR-18 92W M+S

CAR AND DRIVER TEST RESULTS

ACCELERATION		
0–30 MPH	3.5 sec	**3.3 sec**
0–60 MPH	11.2 sec	**10.6 sec**
0–80 MPH	25.5 sec	**20.3 sec**
1/4-MILE @ MPH	18.8 sec @ 73	**18.1 sec @ 76**
ROLLING START, 5–60 MPH	11.8 sec	**10.8 sec**
TOP GEAR, 30–50 MPH	5.5 sec	**5.4 sec**
TOP GEAR, 50–70 MPH	9.5 sec	**8.1 sec**
TOP SPEED	100 mph (drag ltd, *C/D* est)	**120 mph** (drag ltd, *C/D* est)
CHASSIS		
BRAKING, 70–0 MPH	**180 ft**	246 ft
ROADHOLDING, 300-FT-DIA SKIDPAD	0.78 g	**0.79 g**
WEIGHT		
CURB	**2347 lb**	3113 lb
%FRONT/%REAR	63.7/36.3	62.0/38.0
FUEL		
TANK	9.2 gal	**16.4 gal**
RATING	87 octane	87 octane
EPA COMBINED/ CITY/HWY	**33/30/37 mpg**	20/18/25 mpg
SOUND LEVEL		
IDLE	**42 dBA**	57 dBA
FULL THROTTLE	**78 dBA**	89 dBA
70-MPH CRUISE	**76 dBA**	83 dBA

*C/D est.

Tested by ERIC TINGWALL *in California City, CA*

With its double-digit torque rating, the Domino's DXP could have easily made it up this barely inclined driveway. It just didn't want to, okay?

through the dissolving window tint, and the crooks had ripped up the wiring so badly that there was no easy place to plug in the lighted Domino's sign. Turns out that $1000 cars are lousy pizza-delivery vehicles.

With that confirmed, the Eclipse's engine feels strong enough to run another 40,000 or so miles, the A/C blows cold, and the leather is worn but not ripped. And the ride is comfy on the new tires. Sure, it's embarrassing to be seen in. But at the risk of sounding like a John Cougar Mellencamp song, once you defeat your own dignity, it's not that bad.

1. DOMINO'S DXP

At the heart of the Domino's DXP is the somnambulant 2015 Chevrolet Spark, which has the distinction of being more exciting than a Smart Fortwo, though falling short of the thrills of a mall escalator. And while the DXP is merely good at delivering pizzas, it's spectacular at attracting attention.

Converting a Spark into a DXP is straightforward and adds about $9000 to the price, although Domino's won't quote a specific figure. The front passenger's seat and the rear seats get chucked and replaced with mats in back and a molded plastic fixture up front for holding the things Domino's sells that aren't pizza, such as wings, salads, and bottled drinks. Meanwhile, the driver's-side rear door is filleted and bolted shut, and a plastic pizza-carrying box sits behind the oven door where the window once was. Lit by red LED lights, this carrying box has a warming pad at the bottom that Domino's claims will heat up to 140 degrees to keep pizzas toasty. But since there's an air gap between the "Warming Oven" and its outer lid, the term "oven" is stretching it a bit. Stuffed with a couple of pizzas, it does get kind of cozy in there, but that's about it. And since Domino's delivers its pizzas in insulated bags anyhow, the oven doesn't matter much. The DXP conversion takes out much of what little noise insulation there is in a Spark, and the roof sign and Warming Oven door aren't aero-optimized. So at a 70-mph cruise, the cabin throbs with 76 decibels of wind noise, which is a bit louder than a standard Spark. But going 70 mph is expected to be a rare event for the DXP.

The DXP's 84-hp, 1.2-liter four thrashes to churn up the continuously variable transmission, and it takes a grim 11.2 seconds for the DXP to reach 60 mph. But on the tight streets of Isla Vista, the figures don't matter. The DXP hits moseying speed quickly enough, and it's narrow, so it can squeeze among wandering undergraduates in full party mode. And the 32.5-foot turning circle means quick U-ies are easy. The DXP is at home in this college town.

Theoretically, the car can hold up to 80 pizzas, but most Domino's deliveries are a few pies at most. Opening the remotely controlled, hydraulically actuated Warming Oven door is Pizza Theater, and customers love it. Little kids gape at it, while older kids appreciate the somewhat clever vinyl graphics. Parents just nod a lot. The DXP attracts crowds when it's simply parked in front of a Domino's store.

2015 Domino's DXP
[+] Nimble, capable, and likely to sell more pizza than it delivers.
[–] Slow, loud, and no seat for the driver's date.
[=] Mediocre car, great marketing.

For practicality, the DXP's interior should include an integrated notepad and smartphone holder, and a better driver's armrest. And Roush should figure out how to turn off the passenger-airbag warning light, because the two-liter soda bottles sitting there don't care. It's a better delivery vehicle than most random used cars, but it's no quantum leap forward.

Domino's monitors every DXP's condition during its regular store audits and will reacquire each car at the end of its life from the franchisees. Each DXP thus has a date with the crusher; no used DXP will ever deliver for third-tier outlets hawking ketchup and Cheez Whiz on a saltine and calling it pizza.

FINAL RESULTS

Shell V-Power NiTRO+ Premium Gasoline
The Official Fuel of CAR AND DRIVER

Maximum points available

		MITSUBISHI ECLIPSE GT-R	▶ DOMINO'S DXP
RANK		**1**	**2**
VEHICLE			
DRIVER COMFORT	10	**7**	6
ERGONOMICS	10	**7**	5
REAR-SEAT COMFORT	5	0	**3**
REAR-SEAT SPACE*	5	0	**5**
CARGO SPACE*	5	**5**	1
FEATURES/AMENITIES*	10	**10**	2
FIT AND FINISH	10	**7**	3
INTERIOR STYLING	10	**8**	4
EXTERIOR STYLING	10	**8**	3
REBATES/EXTRAS*	5	0	0
AS-TESTED PRICE*	20	1	**20**
SUBTOTAL	100	**53**	52
POWERTRAIN			
1/4-MILE ACCELERATION*	20	17	**20**
FLEXIBILITY*	5	4	**5**
FUEL ECONOMY*	10	**10**	1
ENGINE NVH	10	4	**5**
TRANSMISSION	10	**5**	**5**
SUBTOTAL	55	**40**	36
CHASSIS			
PERFORMANCE*	20	**20**	15
STEERING FEEL	10	**7**	**7**
BRAKE FEEL	10	**8**	2
HANDLING	10	**6**	**6**
RIDE	10	**7**	6
SUBTOTAL	60	**48**	36
EXPERIENCE			
FUN TO DRIVE	25	**12**	10
TOTAL	240	**153**	**134**

*These objective scores are calculated from the vehicle's dimensions, capacities, rebates and extras, and/or test results.

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Bremmer Kraft **BR15**
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Sparco **Assetto Gara**
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Sparco **Pro Corsa**
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Sparco **Terra**
16 17

RADIUS **WI02**
16 17 18

RADIUS **WI16**
16 17

Enkei Perf. **ONX**
17 18 20

Enkei Perf. **PSR5**
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2016 HONDA PILOT ELITE

Arrival: December/2015
Departure: November/2016

Color in the following pages to make our long-term Honda Pilot your own! Just be careful not to overdo it, like we did. _by Jared Gall

When practicality is paramount, all other considerations sit even further back than usual, particularly style. Take three-row crossovers, a genre with space for all manner of considerations. Once you package three rows of seats, plump out the silhouette to maximize interior volume, and pull the beltline low for the sake of visibility, you're left with a fairly bland template onto which to project your brand's aesthetics. Not that buyers in the big-crossover class seem discouraged by their vehicles' sameness—sales success in mainstream segments often requires automakers to color inside the lines. That said, the crossover's role as a minivan surrogate means that plenty of its passengers will color all over the interior.

When Honda redesigned the Pilot for 2016, it lengthened and lowered the triple-row SUV, shucking the previous generation's blocky exterior for a softer form that bears more than a passing resemblance to that other paragon of blandness, a minivan. And specifically, Honda's own activity book, the Odyssey. But both have long been among our favored means of moving large numbers of people and great volumes of junk, and so we lined up a Pilot for a long-haul test. We opted for the ultimate Pilot, the Elite. It came loaded with all-wheel drive, leather, navigation, heated and ventilated front seats, heated second-row captain's chairs, *two* sunroofs, a Blu-ray rear-seat entertainment system with HDMI and RCA inputs, and Honda's full complement of driver-assist features: forward-collision warning with automatic emergency braking, lane-keeping assist, adaptive cruise control, blind-spot monitors, and automatic high-beams. To this hefty load of equipment we added a trailer hitch ($360), roof-rail crossbars ($225), and a rear-bumper appliqué ($70), bringing the total MSRP to $47,955.

Rants & Raves

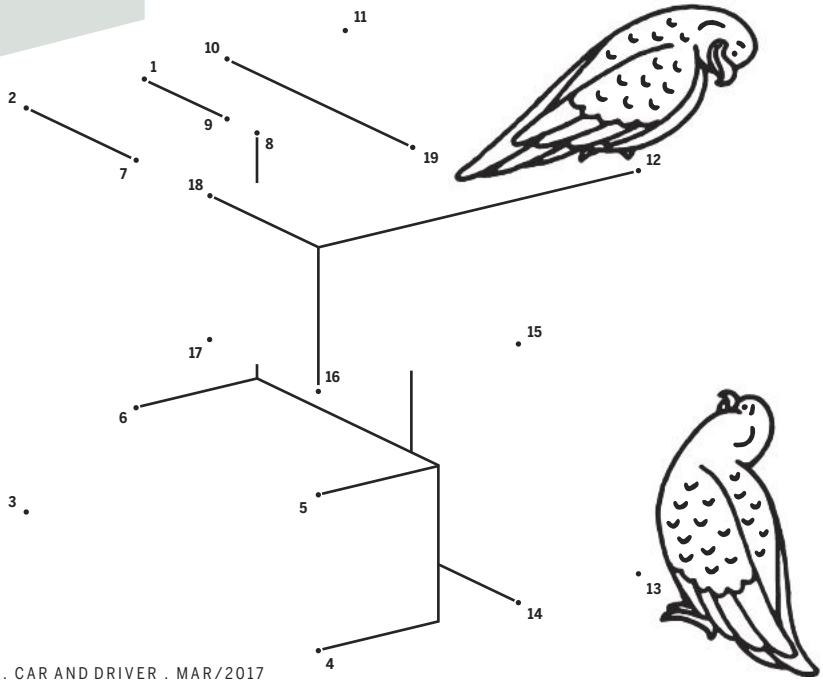
Is the cruise-control system messed up, or does it just suck?
—Rusty Blackwell

How did this throttle calibration ever leave the proving ground? Low-speed and standing-start responses are as bad as I've driven.
—Josh Jacquot

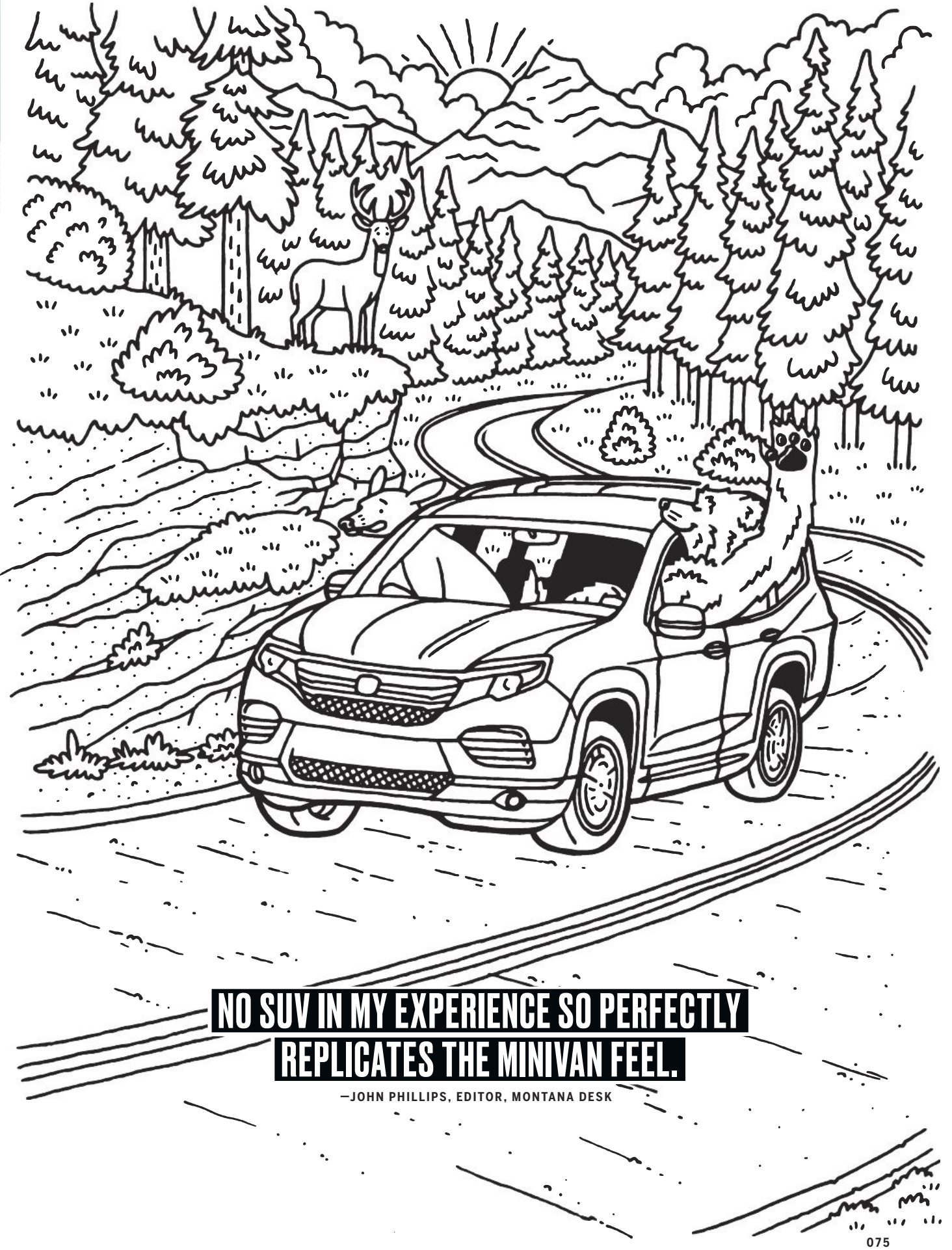
With an abundance of space, comfort, and luxury, the Pilot completed its 40,000-mile assignment in just 11 months. It passed through some 20 states and four Canadian provinces in our hands, once piling up more than 7000 miles in a single month.

Those highway miles helped keep our fuel consumption at an average of 22 mpg, outstanding for a 4351-pound bus. Honda redesigned the Pilot's 3.5-liter V-6, now turning out 280 horsepower and 262 pound-feet of torque, for this generation. Cheaper Pilots back that with a six-speed auto, while the uplevel Touring and Elite trims get a nine-speed.

When new, our Pilot turned in straight-line performance that would beat a Dodge Challenger V-6, with a 6.0-second zero-to-60-mph sprint and 14.6 seconds in the quarter-mile at 95 mph. After 40,000 miles, it slipped a couple of tenths in the quarter, handing the lead back to the muscle coupe. Its braking performance—172 feet to stop from 70 mph new, 178 at the end of the test—places it among the best family



illustrations by NATHAN YODER



NO SUV IN MY EXPERIENCE SO PERFECTLY REPLICATES THE MINIVAN FEEL.

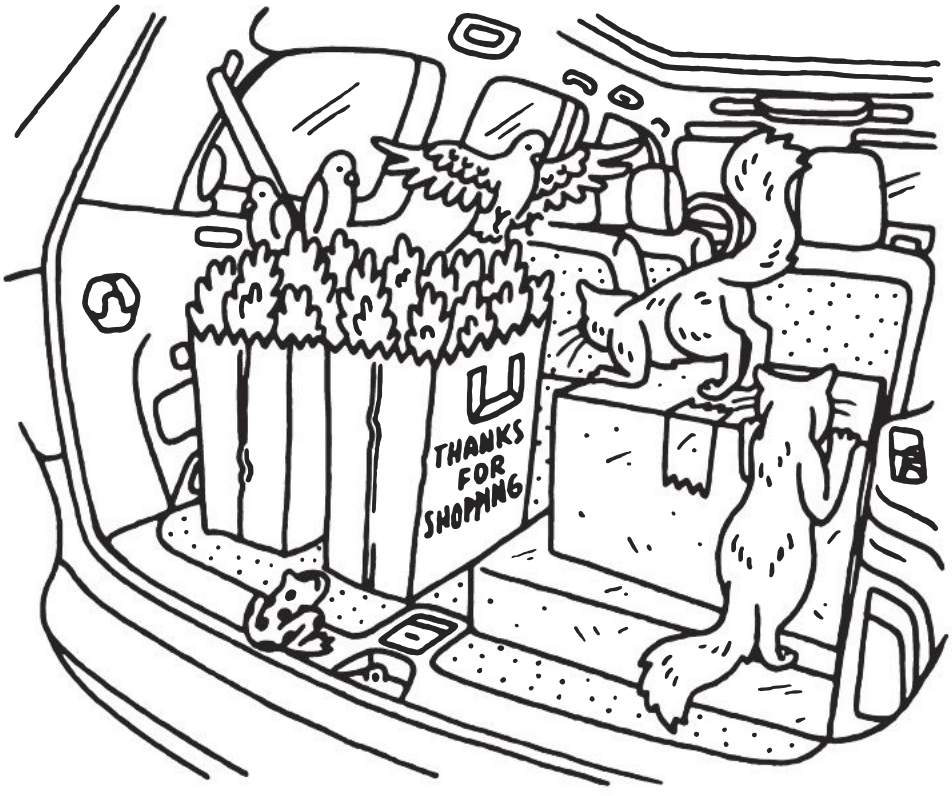
—JOHN PHILLIPS, EDITOR, MONTANA DESK

haulers, and its 0.81-g skidpad performance improved to 0.84 g on worn tires, giving it an edge over many competitors in shopping-cart-avoidance maneuvers.

Its interior is certainly an attractive place to pass the miles. It's inventive, appealing, and loaded with storage bins, cubbies, depressions, and the like. It literally has storage on top of storage. There's the usual map pocket along the bottom of the front doors, with a second tier of receptacles above that, and then the door pull on top, which doubles as a shallow storage cubby. And the console between the front seats could swallow a full-grown Lhasa apso with room for a chew toy or two. Visibility all around is excellent. Riding in back and then switching to the driver's seat made us jealous of the enormous sunroof enjoyed by back-seat passengers, though the entertainment screen that flips down from the ceiling is so small that it might be contributing to the myopia outbreak in today's children.

The second-row captain's chairs fold and slide forward at the touch of a button, offering wide passage to the distant rear seats. Unlike some systems that power the seat forward slowly, the Pilot's have an electronic actuator, and they slide forward with a satisfying, spring-loaded mechanical quickness. One staffer called them "a game changer." In back, we found so much space that even our lankiest lunks had sufficient headroom. The trade-off is that if all seven seats are occupied, there's barely space for each passenger to pack a lunchbox between the third-row seatbacks and the power rear hatch. Now that the Pilot looks ever more like the Odyssey, the storage sting feels especially sharp. The Odyssey allots an extra 20 cubic feet each to people and stuff.

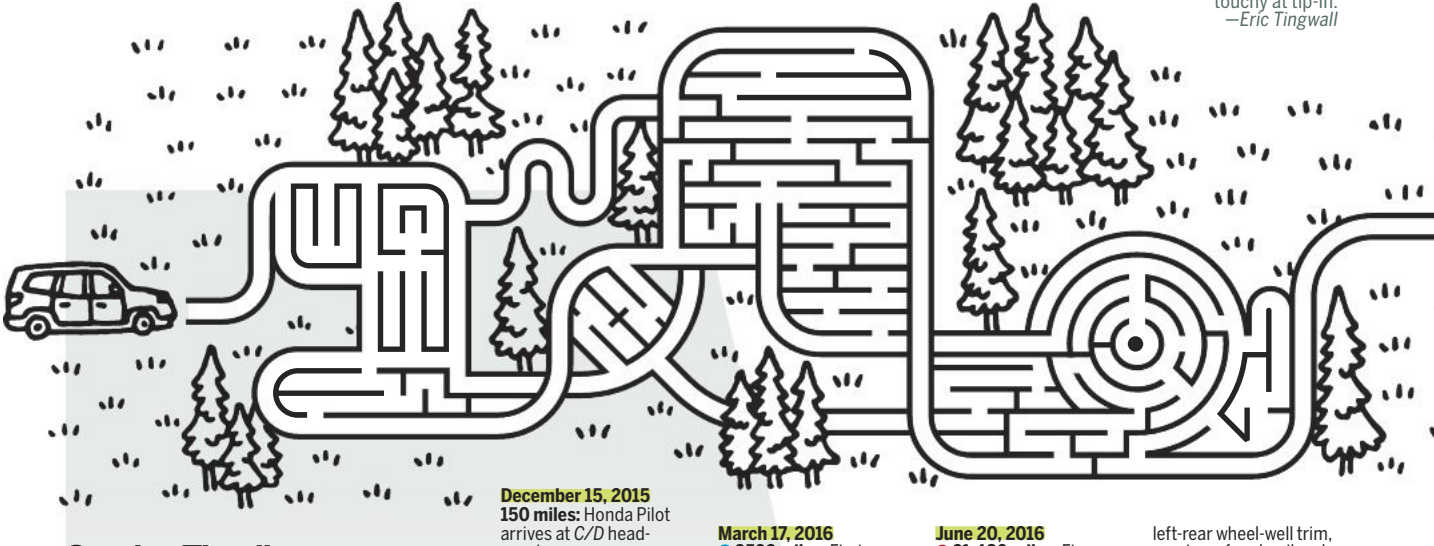
Our Pilot did its part to continue Honda's reputation for trouble-free ownership. It required zero unscheduled service visits, and the total for four visits at 10,000-mile intervals squeezed in at less than $600. However, we also did our part to continue our reputation by twice backing the big Honda into things. The first time, a pipe in a parking garage skewered the left-rear quarter panel. The subsequent repair also required replacing the left-rear wheel-well trim, repair roof-rack rail and bumper cover, $986



Rants & Raves

The one-touch sliding second-row seats are a game changer for parents of small children.
—Dave VanderWerp

The primary controls were clearly secondary concerns. The brake pedal is too soft, and the throttle is too touchy at tip-in.
—Eric Tingwall



Service Timeline:
Easy livin'.

Key: - Repairs - Damage - Maintenance - Normal Wear - Oil Additions

December 15, 2015
150 miles: Honda Pilot arrives at *C/D* headquarters

January 8, 2016
2327 miles: Bridgestone Blizzak DM-V2 winter tires installed

March 17, 2016
9592 miles: First service: oil change, $46

April 13, 2016
10,434 miles: All-season tires remounted

June 20, 2016
21,480 miles: Fix damage from scraping against a pipe in a parking garage. Repair and refinish left-rear quarter panel, replace

June 21, 2016
21,594 miles: Second service, including oil

DEC/15 JAN/16 FEB/16 MAR/16 APR/16 MAY/16 JUN/16 JUL/16

Almost like a pickup in that the ride quality improves when it's loaded down.
—Joseph Capparella

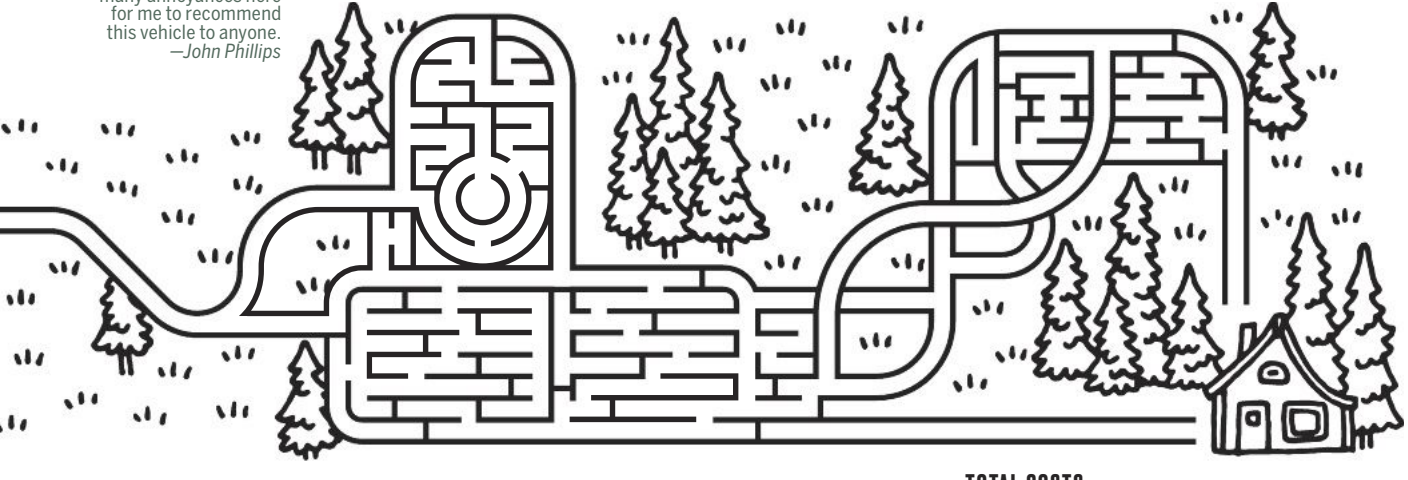
If only there were knobs and physical buttons for the infotainment system.
—Jennifer Harrington

There are way too many annoyances here for me to recommend this vehicle to anyone.
—John Phillips

quent metalwork and some new plastic trim pulled $986 out of our indiscretionary spending account. Not even three months later, a post ambushed the same corner, but this time the damage was less. A new plastic trim piece cost only $23.

As satisfying as the Pilot is when stationary, the logbook was filled with numerous, er, off-color comments. Honda found a startling array of fussy ways to make the Pilot call negative attention to itself. The annoyances begin before you even start driving, with a nonsensical push-button shifter in which park and neutral are the same size buttons in different planes, drive is a different size and shape (and nested at an angle in a chrome trim ring), and reverse is a pull switch. That these buttons and switches take up precisely as much space on the console as a regular shifter won them no friends.

And yet, while the Pilot is naturally predisposed to road trips, every staffer who's driven Honda's Ridgeline—with which the Pilot shares its underpinnings—has climbed out of the pickup and wondered



MAZE BY MARTIN LAKSMAN

change, tire rotation, and rear-differential-fluid replacement, $242

August 29, 2016
31,198 miles: Change oil, rotate tires, replace cabin and engine air filters, $154

September 2, 2016
31,490 miles: Replace damaged left-rear wheel-well trim, $23

September 13, 2016
32,064 miles: Swap back to winter tires for trip to Montana

November 28, 2016
40,913 miles: Oil change, tire rotation, and inspections, $153

40,914 miles: Long-term test concludes

TOTAL COSTS

MAINTENANCE	$595
NORMAL WEAR	$0
REPAIR	$0
DAMAGE AND DESTRUCTION	$1009
GASOLINE (@ $2.05 PER GALLON)	$3727

SERVICE

DEALER VISITS (SCHEDULED/UNSCHEDULED)	4/0
DAYS OUT OF SERVICE	4
UNSCHEDULED OIL ADDITIONS	0 qt

aloud why Honda doesn't offer its firmer suspension in the Pilot. The looser Pilot occasionally feels as if it's manufacturing its own crosswinds. There's plenty of fore and aft bobbing, too, thanks to the adaptive cruise control's abrupt braking. The system also hunts endlessly through the gears and often accelerates well beyond its set speed, meaning that few drivers left the active function engaged.

Around town, the throttle and transmission calibrations are so jumpy that several of us took to driving the Pilot in economy mode for the more tolerable, relaxed programming. Similarly, the engine stop-start system's logic lags its peers, on several occasions shutting the engine off in the middle of parallel-parking maneuvers. These are commodity systems now—they should be simple and intuitive. That good examples are found in economy cars but not in a nearly $50,000 Honda is supremely disappointing.

Nearly every mainstream car brand in the U.S. today sells a three-row crossover, giving the Pilot about a dozen direct competitors. If you stretch a few grand beyond the extremes of the Pilot's pricing spectrum, it has about that many indirect competitors, too. Few are as attractively finished as the Pilot, and fewer still are likely to offer such an affordable ownership experience. But most share its core competencies, and few are as annoying in full trim. The Pilot is a good crossover; the Pilot Elite is a good crossover overwhelmed by the very thing an activity book is supposed to alleviate: fussiness.

B	O	P	I	T	M	A	D	D	E	N	I	N	G	S	S	O	N	M
U	N	S	O	R	T	E	D	T	G	U	X	J	H	N	W	W	R	I
E	L	B	I	S	N	E	H	E	R	P	M	O	C	N	I	R	I	N
E	S	A	P	P	A	L	L	I	N	G	R	F	U	D	J	Q	R	I
M	L	Z	Y	S	U	O	L	Z	A	T	M	J	U	M	P	Y	E	V
S	H	B	F	I	D	E	A	L	S	Z	C	Y	H	S	U	M	A	A
B	L	R	A	C	Y	I	R	I	F	F	L	U	F	E	S	U	S	N
D	A	G	T	T	J	V	G	L	A	C	I	G	O	L	L	I	O	N
E	C	N	Y	L	R	H	E	S	I	M	O	R	P	M	O	C	N	O
N	I	I	O	T	T	O	G	N	I	R	R	A	J	R	D	E	A	Y
M	T	Y	H	E	A	L	F	Z	L	W	G	E	K	R	T	Q	B	I
A	C	R	D	U	J	O	R	M	T	M	V	S	I	L	L	Y	L	N
D	A	R	G	Z	E	F	L	N	O	C	H	E	B	I	B	C	E	G
G	R	O	M	A	A	V	P	F	T	C	W	Y	K	A	L	F	W	R
K	P	W	R	E	G	N	A	H	C	E	M	A	G	D	X	G	O	F

Our assessment of the Pilot was not entirely favorable. In the jumble above, find these descriptors copied from its logbook.

ANNOYING
APPALLING
BOP IT
COMFORTABLE
COMPROMISE
DAMNED
FLAKY
FLOATY
GAME CHANGER
IDEAL
ILLOGICAL
INCOMPREHENSIBLE
JARRING
JUMPY
LOUSY
MADDENING
MINIVAN
MUSHY
PRACTICAL
REASONABLE
SHORTSIGHTED
SILLY
UNSORTED
USEFUL
WEIRD
WORRYING

2016 HONDA PILOT ELITE AWD

PRICE AS TESTED **$47,955**
BASE PRICE **$47,300**

VEHICLE TYPE: front-engine, all-wheel-drive, 7-passenger, 4-door hatchback
ENGINE TYPE: SOHC 24-valve V-6, aluminum block and heads, direct fuel injection

DISPLACEMENT ..... 212 cu in, 3471 cc
POWER ..... **280 hp @ 6000 rpm**
TORQUE ..... **262 lb-ft @ 4700 rpm**
TRANSMISSION ..... 9-speed automatic with manual shifting mode
WHEELBASE ..... 111.0 in
LENGTH ..... 194.5 in
WIDTH ..... 78.6 in
HEIGHT ..... 70.4 in
CURB WEIGHT ..... 4351 lb

WARRANTY

3 years/36,000 miles bumper to bumper
5 years/60,000 miles powertrain
5 years/unlimited miles corrosion protection
3 years/36,000 miles roadside assistance

MODEL-YEAR CHANGES

2017: EX and higher trims add Android Auto and Apple CarPlay integration.

CAR AND DRIVER TEST RESULTS

PERFORMANCE

ZERO TO 60 MPH:
NEW ..... 6.0 sec
40,000 ..... 6.0 sec
ZERO TO 100 MPH:
NEW ..... 16.7 sec
40,000 ..... 16.9 sec
ZERO TO 110 MPH:
NEW ..... 21.1 sec
40,000 ..... 21.7 sec
ROLLING START, 5–60 MPH:
NEW ..... 6.2 sec
40,000 ..... 6.3 sec
1/4-MILE:
NEW ..... 14.6 sec @ 95 mph
40,000 ..... 14.8 sec @ 95 mph
BRAKING, 70–0 MPH:
NEW ..... 172 ft
40,000 ..... 178 ft
ROADHOLDING, 300-FT-DIA SKIDPAD:
NEW ..... 0.81 g*
40,000 ..... 0.84 g*
TOP SPEED (GOVERNOR LIMITED) ..... 113 mph
EPA FUEL ECONOMY, COMBINED/CITY/HWY ..... 22/19/26 mpg
***C/D*-OBSERVED FUEL ECONOMY** ..... 22 mpg

LIFE EXPECTANCIES

(ESTIMATED FROM 40,000-MILE TEST)
TIRES ..... 65,000 miles
FRONT BRAKE PADS ..... more than 100,000 miles
REAR BRAKE PADS ..... more than 100,000 miles

WHAT BITS AND PIECES COST

HEADLAMP $827
ENGINE AIR FILTER $29
OIL FILTER $9
WHEEL $511
TIRE $297
WIPER BLADES (LEFT/RIGHT/REAR) ..... $39/$35/$25
FRONT BRAKE PADS $80

5-YEAR ESTIMATED COST OF OWNERSHIP

YEAR	❶	❷	❸	❹	❺	TOTAL
DEPRECIATION	$15,136	$3784	$3311	$4257	$2838	**$29,326**
FINANCING	$1305	$1034	$754	$465	$166	**$3724**
FUEL	$1398	$1432	$1500	$1636	$1773	**$7739**
INSURANCE	$1743	$1776	$1812	$1848	$1885	**$9064**
TAXES AND FEES	$2487	$71	$68	$66	$62	**$2754**
MAINTENANCE AND WEAR	$64	$248	$399	$64	$1688	**$2463**
REPAIRS	$0	$0	$0	$0	$418	**$418**
TOTAL	**$22,133**	**$8345**	**$7844**	**$8336**	**$8830**	**$55,488**

Depreciation data from ALG. Based on 15,000 miles per year.

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Fleet Files:
Here's how our other long-term vehicles are faring in their 40,000-mile trials:

Newcomer

2016 NISSAN TITAN XD PRO-4X DIESEL

Arrival: July/2016
Miles: 14,537 Observed mpg: 15

—

COLLECTORS OF VARIOUS and sundry crapheaps that we are, we recently welcomed a 2016 Nissan Titan XD into our fleet to help with the moving of said crapheaps (and other detritus). Not a crapheap but a curious tweener, the XD version of the second-gen Titan is technically a heavy-duty truck, yet its 12,037-pound tow rating is closer to a half-ton rig's. We opted for a massive crew-cab Pro-4X model, which nets four-wheel drive, additional off-road gear, and loads of standard equipment. The Convenience ($3310) and Utility and Audio ($1100) packages add leather upholstery, a booming stereo, and a raft of amenities, with a few smaller extras upping the MSRP to $57,155. But the Titan doesn't impress like a $60,000 truck—especially from inside the cabin—and its six-speed Aisin automatic is short on refinement. A 310-hp Cummins V-8 diesel with 555 pound-feet of torque makes the Titan an able tugboat, but at 7280 pounds, the truck dawdles to 60 mph in a noisy 9.4 seconds. Besides returning a disappointing 15 mpg, the Cummins has a serious thirst for emissions-scrubbing diesel exhaust fluid (16 gallons added so far). Even so, the Titan's first 7500 miles of crap hauling rolled up in just two months. *–Mike Sutton*

2016 BMW 740i

Arrival: Apr/2016
Miles: 28,090
Observed mpg: 27

—

We didn't expect the 740i's small engine to be so perfectly suited to this big car. The 3.0-liter inline-six seamlessly alternates between enthusiasm and subtlety. And if it has to work harder at times to motivate 4385 pounds, well, that just helps showcase its range. The remarkable fuel economy allowed one driver to stretch the 20.6-gallon tank to 700 miles. That's one of many attributes that make this quiet cruiser a divine road-tripper. But while the 7-series floats down the freeway like a pontoon in calm waters, the tires do hammer the pavement. To date, we've replaced two damaged Bridgestones at a total cost of $874. We also paid $486 to replace a fog-light cover and a lower side grille after a raccoon crossed the street without looking both ways.
—Eric Tingwall

2016 Chevrolet Camaro SS coupe

Arrival: Feb/2016
Miles: 20,859
Observed mpg: 20

—

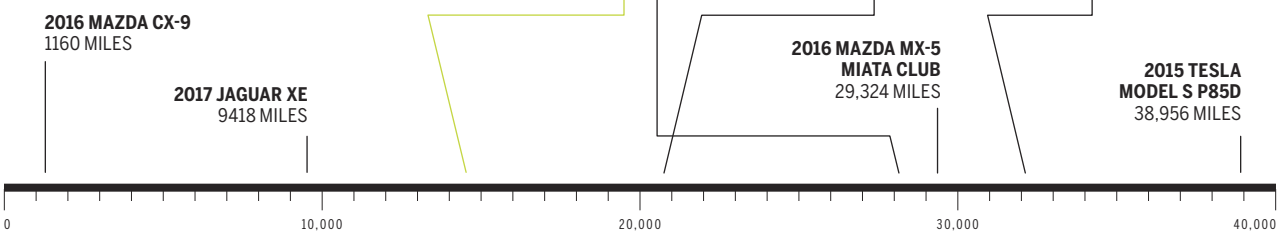
Because powerslides are loved by eight-year-olds and *C/D* editors alike, we've taken to cramming our families into the 455-hp coupe at every opportunity. Having spent the summer logging miles in and around Ann Arbor, we fitted a set of Pirelli Sottozero winter tires to continue the Stig Blomqvist impersonations into the low-grip season. Though it's not leaking or overtly smoking, we've added 4.5 unscheduled quarts of oil to the LT1's crankcase over the course of the Camaro's first 20,000 miles (in addition to regular changes at 7000 and 15,000 miles). GM says that falls within the range of acceptability. Even so, when fully throttled, no other long-termer makes us want to channel Lee Greenwood.
—Josh Jacquot

2016 Ford Mustang GT coupe

Arrival: Oct/2015
Miles: 32,123
Observed mpg: 20

—

Life has been pretty quiet for our Mustang GT lately, mostly commuting locally and tooling around the Midwest. Our car's spartan interior and Recaro sport seats have steered most drivers toward some of the more accommodating alternatives in our fleet for lengthier trips. The presence of the quicker and more luxurious Camaro SS certainly hasn't helped, either. We still love the Mustang's 435-hp V-8, as attested to by a heavily worn pair of rear Pirellis ($480 to replace). That we're averaging 20 mpg is impressive, too. Its brakes have become excessively grabby during the Ford's stay with us, and the drivetrain makes disconcerting clunks when shifted through the lower gears. But we're still not looking forward to giving the GT pony car back in 8000 miles.
—Mike Sutton



photography by MICHAEL SIMARI

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For the Love

Lexus courts enthusiasts with an engaging flagship **V-8 coupe** and a hybrid to match. _by Dave VanderWerp

LEXUS IS CONSISTENTLY one of the best-selling luxury brands in the U.S., but its invisibility is as much a part of its identity as its ubiquity. The legions of Lexus buyers may be quietly satisfied, but by and large, they aren't the type who buy the hat and join the owner's club. Well, we've long subscribed to what Toyota president Akio Toyoda said recently, which is that the long-term success of Toyota and Lexus (and, really, any automotive brand) means making products that inspire passion, not just respect. Which is why Toyoda is willing to pour a ton of money into a car that won't sell in high volume and is the antithesis of today's SUV-everything world. Indeed, Toyoda-san makes it his personal mission to prevent the word "boring" from appearing ever again in a sentence with "Lexus." Enter the LC, which stands simply yet ambitiously for Luxury Coupe, available in V-6 hybrid or V-8 forms. If the car is any indicator of things to come, we'd say he's well on his way to succeeding.

A few minutes' drive of the LC500 on the sinuous and extremely well-maintained back roads of southern Spain was all it took to have this epiphany: There's actual road texture being transmitted through the well-shaped and expertly finished steering wheel. This much-desired line of communication has all but disappeared in the age of electrically assisted power steering and a misguided neutering billed as progress. In the new Lexus, while the effort is on the light side at highway speeds, the wheel imparts a natural confidence when hustling down wriggling roads. The LC feels alive when pushed hard; the suspension is tied down, there's little body roll, and the coupe transitions from corner to corner athletically.

In addition to the steering, Lexus nailed the thundering V-8 sound. Powered by the same 5.0-liter V-8 that's in the GS F and the RC F, the LC500 is up a few horsepower, to 471. With the help of a tube running between the intake manifold and the firewall, plus flaps in the exhaust (but no electronically generated noise), the cabin is positively filled with nigh-on-perfect V-8 frequencies, the sound swelling appropriately with engine speed but stopping short of being assaultive. The current march toward turbocharging is working against memorable engine notes, making the LC500's naturally aspirated roar even more of a standout.

Playing along with this V-8 opus is a new rapid-fire Aisin 10-speed automatic. It's not as quick-shifting as a dual-clutch

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[+] Comes alive when pushed, communicative steering, booming V-8, stunning shape.
[–] Hybrid is far less compelling than the V-8, small trunk and back seat.

gearbox, and we also experienced a few low-speed shift bobbles, but gear swaps are about as swift as they come for conventional automatics, and the 10-speed punctuates upshifts with a satisfying pop from the exhaust. Paddle-requested downshifts are exceptionally swift, too.

The LC isn't a track car, nor do we think it should be, but Lexus seemed intent on demonstrating the car's inherent understeer by furnishing us with a track to drive on. A variable-ratio rack and rear-wheel steering are both available. We'd skip them, however, as we found the transition from understeer to power oversteer difficult to read in the rear-steering car. Although we suspect that this behavior is due to the additional steering gadgetry, we didn't get the chance to drive a car without it on the track to verify our theory. A car with the base setup did feel more communicative and confidence-inspiring during an impromptu drift session on Andalusian roundabouts.

The opposed-piston brake calipers on both axles do an excellent job of hauling the LC down from high speeds. Engineers focused their weight-loss efforts on the extremities of the car; doing so diminishes the polar moment of inertia, improving rotational response while also keeping the center of gravity near the middle of the car. This includes the use of aluminum for the hood, front fenders, and door skins, with the inner panels of the doors and trunk made from carbon-fiber-reinforced sheet-molding compound (that's the random-oriented fiber stuff, not the neatly entwined weave). There's also an optional carbon-fiber roof made from the pretty weave. On the Lexus LC's exterior, only the deep-draw rear fenders are rendered in steel.

Still, the LC500 weighs roughly 4300 pounds, with the LC500h hybrid adding an additional 150. That essentially matches the slightly larger but more conventionally constructed BMW 650i, which also has a V-8. In the Lexus, the mass is front-biased, with a claimed 54/46 percent front-to-rear distribution for the V-8 and 52/48 for the hybrid. Both LCs wear the same 20- or 21-inch wheels with available top-shelf Michelin Pilot Super Sport or Bridgestone Potenza S001 tires—no efficiency-oriented low-rolling-resistance rubber here—and the hybrid retains the prominent tachometer and the large magnesium shift paddles of the V-8–equipped car.

Substantial alterations to Toyota's Hybrid Synergy Drive hardware allow it to mimic the conventional 10-speed automatic in the V-8. The new arrangement, called the Multi Stage Hybrid System, starts with the basic building blocks from the GS450h, which has an Atkinson-cycle 3.5-liter V-6 connected to two electric motor/generators through a planetary gearset to produce a pseudo CVT. The V-6 replaces the 438-hp V-8 from the LS600h hybrid so that, unlike the LS hybrid, the gas-electric LC offers a meaningful fuel-economy benefit. The new part is that a conventional four-speed automatic gets tacked on to the back of the CVT. This allows for more electric assist at lower speeds and enables the system to operate with the engine off at speeds up to 87 mph, though the only practical way to make this happen is to coast and then allow the electric powertrain to take over. And EV-only range, as is typical with Toyota and Lexus hybrids, is still minuscule, with the slightest prod of the

AUTO OSSICONES
The two stumps protruding from the LC's instrument binnacle control drive-mode and traction-control settings.

Top: In the '70s we had a pair of corduroy trousers exactly the color of this LC's upholstery. The Lexus wears it slightly better. But only slightly.

throttle often causing the engine to fire.

Unfortunately, the LC loses all its lovely sound when it goes hybrid. Unlike the V-8 model, the wired-up LC employs electronic enhancement, and its artificial moaning is further amplified in sport S-plus mode. The hybrid is also down 117 horsepower compared with the V-8. Does anyone looking to spend six figures on a two-door fashion statement care about the LC500h's potential 50 percent fuel-economy benefit if it means sacrificing the V-8's sound and performance? Lexus claims that the new hybrid powertrain makes the LC500h only a few tenths of a second slower to 60 mph, but at higher speeds, the performance gap widens dramatically. Plus, the hybrid's pseudo 10-speed slurs its shifts, making them far less satisfying than those of the V-8's automatic.

Both dimensionally and psychologically, the LC is a bit of a tweener among the limited luxury-coupe offerings. Its wheelbase roughly splits that of the Mercedes-Benz C- and S-class coupes, with an overall length more than 10 inches shorter than the S, which helps to explain the LC's paltry trunk and back-seat space. So it's a more dynamic grand-touring alternative to the S-class or 6-series coupes, but the LC isn't nearly as dynamically gifted as a Porsche 911, which is roughly 1000 pounds lighter. The styling certainly isn't as classically beautiful as that of the S-class coupe. Even so, the aggressively creased design language that seems hopelessly overdone on the Lexus RX crossover works here, thanks to the coupe's excellent proportions.

The interior design is also adventurous in a good way, with flowing sweeps over the door panels and through the center console and a high level of detail execution throughout. The base seats are heavily bolstered, and the sportier buckets in optional microsuede trim on upgraded versions are even more so. But we wonder if both might fit a little too tightly for the luxury-coupe clientele. They have surprisingly few adjustments; there's no bolster or thigh-control adjustment and only two-way lumbar.

The mission to build exciting cars should help court enthusiasts going forward. It also portends good things for the new LS sedan [see Reveal of the Month, page 017], which will ride on a larger version of the LC's all-new front-engine, rear-drive architecture, dubbed GA-L (for Global Architecture-Luxury). And the company promises an increased focus on dynamics across the lineup going forward, although that doesn't necessarily mean it is aiming to be the most athletic in every segment. LC chief engineer Koji Sato is a former chassis engineer, so perhaps the high priority he places on steering isn't all that surprising. He was utterly flabbergasted when we mentioned that other automakers such as BMW tell us that their car's steering feedback is deliberately diminished because that's what some customers want. Yeah, we don't really believe it, either.

Of the 4800 expected annual LC sales in the U.S., Lexus says it's anticipating only a 20 percent take-rate for the hybrid. That may be aiming high. You'll likely start noticing LCs—most certainly V-8 models—at car shows near you shortly after they go on sale in the spring. The owners may even be wearing Lexus hats.

2018 LEXUS LC500/500h

VEHICLE TYPE: front-engine, rear-wheel-drive, 4-passenger, 2-door coupe
BASE PRICE: $95,000–$100,000 (est)
ENGINES: DOHC 24-valve 3.5-liter Atkinson-capable V-6, 295 hp, 257 lb-ft + 2 permanent-magnet synchronous AC electric motors, 177 hp, 221 lb-ft; combined system, 354 hp; DOHC 32-valve 5.0-liter Atkinson-capable V-8, 471 hp, 398 lb-ft
TRANSMISSIONS: 10-speed automatic with manual shifting mode, continuously variable + 4-speed automatic with manual shifting mode
DIMENSIONS
WHEELBASE: 113.0 in
LENGTH: 187.4 in
WIDTH: 75.6 in
HEIGHT: 53.0 in
PASSENGER VOLUME: 80–81 cu ft
TRUNK VOLUME: 5 cu ft
CURB WEIGHT: 4300–4450 lb
PERFORMANCE (*C/D* EST)
ZERO TO 60 MPH: 4.4–4.7 sec
ZERO TO 100 MPH: 10.1–10.7 sec
1/4-MILE: 12.9–13.8 sec
TOP SPEED: 155–168 mph
FUEL ECONOMY
EPA COMBINED/CITY/HWY: 21–27/18–25/27–35 mpg (*C/D* est)

tech highlight

TO INFINITY AND BEYOND

The LC's taillights harness the infinitely reflective effect of two mirrors facing each other to create the illusion that the lamp is much deeper than its actual three-inch thickness. Each lamp uses 80 LEDs positioned deep in the assembly to paint a long-tailed L shape. The outer reflective plate of the lens allows half the light to pass through it, while the remainder of the light bounces back to the inner mirror. The inner surface then reflects the full intensity back to the partially reflective outer plate. This back-and-forth ricochet means the glow of each repeating L-shaped image is, to the outside observer, roughly half as bright as the one below it as they seem to recede into a deep abyss. Lexus says it's been tinkering with the concept for more than a decade, and it comes to life for the first time with the help of lighting supplier Koito Manufacturing Co. Separate lighting elements handle braking and turn-signal duties.

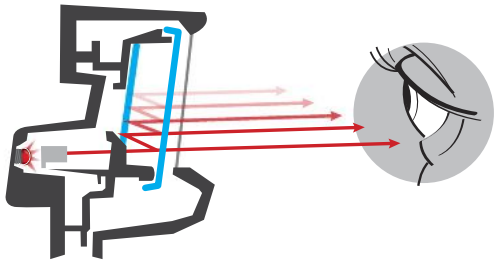

ILLUSTRATION BY PETE SUCHESKI

Too Legit to Quit

AMG's **E63 S** returns with more power, more gears, and a drift mode. _by Tony Quiroga

SEDANS WITH SUPERCAR POWER are common enough now, but 30 years ago, making a road bullet out of a four-door was a novel idea. AMG further radicalized the notion by applying it to a prudish and sober W124 Mercedes-Benz E-class, which may be why the original AMG Hammer, a 355-hp supersedan that could hunt the supercars of the mid-to-late '80s, hasn't let go of any enthusiast's imagination yet. Or, clearly, AMG's: The madness of the original Hammer is alive and well in this over-the-top E-class. And while they aren't called Hammers anymore, maybe they should be. "E63 S 4MATIC+" has all the romance of a Wi-Fi password.

Mercedes-AMG made sure that its new E63's credentials are in order, as it will only be fitting the 603-hp "S" version of its twin-turbo 4.0-liter V-8 to U.S.-bound cars, on sale this summer as 2018s. Other markets will get a base version with 563 horsepower, but it's presumably not Hammer-y enough for Americans. It replaces last year's 5.5-liter V-8 that made 577 horsepower in the S version and is the same engine that rips in the AMG GT R [see page 096], the C63, and even the G-wagen.

As with the other versions of the 4.0-liter V-8, the E63's is a "hot V," which means its turbos are nestled between the cylinder banks to improve throttle response. For E63 duty, it gets 18.9 psi of boost and new twin-scroll turbos that segregate exhaust pulses upstream of the turbo's impeller to reduce turbo lag. Like all AMG V-8s, the engine is made in AMG's home in Affalterbach, Germany, where a single technician is assigned to each engine.

After driving the latest E63, it seems naive to have been at all worried about the effects of the reduced 4.0-liter displacement. Power builds instantly and hits every bit as hard from low rpm as the old 5.5-liter. The 7000-rpm redline arrives so quickly in first and second gears that there's no time to gasp. Even past 100 mph, the E63 flips the digital speedometer in clumps of threes and fives like a supercar.

A nine-speed automatic replaces the last E63's seven-speed. Introduced in the E300 last fall, the nine-cog gearbox is strengthened to handle the engine's 627 pound-feet of torque. In place of the conventional E-class's torque converter is AMG's wet multiplate clutch that can be slow to call up drive when switching from park or reverse, but the clutch pack does cope well with stop-and-go driving and allows for aggressive launch-control starts. Shifts snap off with increasing urgency as you cycle from comfort to sport to sport-plus, and finally to race. Passing times should be class leading as the transmission cracks off multigear downshifts immediately. Best of all, we didn't notice

[+] Gonzo performance and opulent comfort, all-wheel drive or rear-drive and anything between, sounds righteous.
[-] Even heavier and more expensive than before.

What owners say about V1...

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Where's the radar? An arrow lights up, pointing either Ahead, to the side, or Behind. And, amazingly, it's never wrong.

★★★★★ *Arnie R., Atlanta, GA*

So easy to operate, a box with one knob. No need to poke around at full-arm's reach for little buttons the size of rice grains.

★★★★★ *Glenna R., Dallas, TX*

Love the arrows! Where's the radar? They tell me every time. A detector without the arrows is like a car without headlights.

★★★★★ *Chas S., Charlotte, NC*

Situation Awareness you can trust. With the Radar Locator arrowing toward threats, and the Bogey Counter telling how many threats you face, V1 makes defense easy.

★★★★★ *Cal L., Trenton, NJ*

I've owned my V1 since 2001, and I've had it upgraded twice. I trust the arrows to point out every radar trap. When I know *where*, I know how to defend.

★★★★★ *Ed H., Las Vegas, NV*

How can anyone not be smitten by the Arrows? Radar ahead needs a different defense than radar behind. When I know where, I know what to do. When I put the threat behind me, the arrows confirm it. Without the arrows, you're guessing.

★★★★★ *Rob R., Sacramento, CA*

This is the slam dunk best radar detector. No databases to keep updating, or other "features" I'll never use. Instead V1 tells me the important stuff—the Bogey Counter tells you how many threats within range and the red arrows tell where they are.

Trust...V1 earns it one ambush at a time.

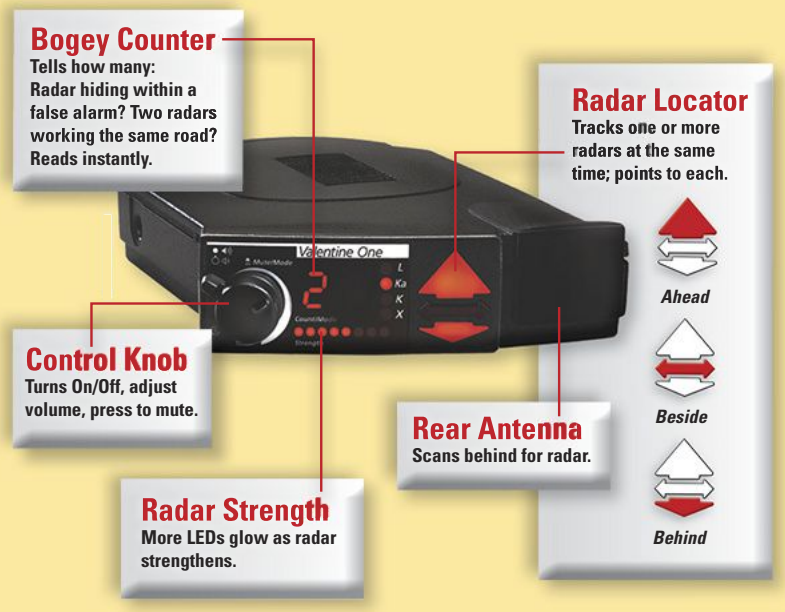
★★★★★ ***Harold B., Houston, TX***

On my way home this afternoon I was following another detector user. I could see red blinking in his windshield as we went past the first radar. Thinking the danger was behind, Mr. Ordinary Detector User hit the gas.

Uh-Oh. **V1's Radar Locator was showing two arrows, one pointing toward the trap now behind, and a second arrow ahead. The "2" on the Bogey Counter confirmed we were being double teamed.**

Sure enough, Mr. O. D. User cruised into the second trap up the hill at 15 over and got himself a blue-light special.

V1 points to *every* trap. I trust it completely.



Mike Valentine
Radar Fanatic

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any of the incessant shifting that plagues other nine-speed automatics. The top gear is tall for fuel economy and also quiet, reducing engine speed below 2000 rpm at 80 mph.

Mercedes-AMG claims a very believable zero-to-60-mph time of 3.3 seconds and greatly simplifies the car's launch-control actuation. In sport, sport-plus, and race modes, simply push the brake with your left foot and floor the accelerator with your right. Revs hold at 4000 rpm and can be lowered using the paddles on the steering wheel. Releasing the brake is like letting the leash go on a straining pit bull with a squirrel in her sights. Put your trust in launch control, and the E63 surges forward resolutely—the nose stays put, and aside from the forces pushing you into the seat, there's entirely less drama than you'd expect of a car this quick. The only thing keeping your grandmother from a 3.3-second run to 60 is what it'd do to her neck. Please, Hammer—er, E63 S 4MATIC+—don't hurt her.

As on the previous E63, all-wheel drive is standard and makes an excellent foil for the boosted V-8. Unlike its predecessor, which had a fixed torque split, the E63's power can vary on the fly between the front and rear axles. In back, an electronically controlled limited-slip differential shared with the C63 controls the locking force side to side. The new system allows Mercedes-AMG to add a "drift" mode that will send 100 percent of the engine's torque to the rear.

Getting the E63 S into drift mode is cumbersome. Set the car to race mode, disable stability control, select manual mode, and hold both paddles until the screen asks if you'd like to enter drift mode. Pull the right paddle on the steering wheel to confirm. Get it right and your E63 S 4MATIC+ turns into a 2MATIC until you turn it off or switch modes. We didn't get to try it. In the interest of saving the 295/30ZR-20 Pirelli P Zeros, the cars on hand during our road drive had drift mode disabled.

As you'd expect, AMG shifts the E-class's personality a few bars toward the coke-snorting lunacy of the '80s, but when you're trundling around with the car set in comfort mode, it's quiet, the air springs yield a compliant and supple ride, and the engine can even run as a four-cylinder. Even in comfort mode, the steering efforts are high but get much heavier in the more serious modes. The feedback is good but with enough Mercedes-Benz creaminess to make the car read as supremely refined when you're not driving it hard.

Switching to sport and modes beyond tightens the suspension, quickens shifts, increases steering effort, and causes the speakers to amplify the engine's noise. It's cheating, but it's cheating for our team and, more important, it doesn't sound fake. From the outside, the sport exhaust barks with the same anger as the old naturally aspirated 6.2-liter V-8 when under load. When cruising along on the highway, where 100 mph feels more like 60, the engine is subdued and the sound is never burdensome.

Mercedes isn't ready to divulge what the U.S.-bound model will weigh, but we're told to expect a 33-pound gain over the last generation. That means the new E63 should hit the ground at nearly 4500 pounds. On track, cornering grip is good, the chassis is playful under power, and it's possible to get the rear end to come around, even without drift mode. But there's no escaping the mass of the E63. It'll bear everything you ask of it on track, but at a not-insubstantial cost to the tires.

We can't imagine that any owners of this likely $105,000 sedan will take it to the track. What we love—and what we've loved about every E-class ever done by AMG—is that the performance gets heightened without disturbing the luxury. Even a car dubbed the Hammer never forgot it was a luxury sedan.

The E63 S shown above has the modern equivalent of the Hammer's super-'80s, monochromatic, color-keyed-wheels look: matte paint and black wheels.

2018 MERCEDES-AMG E63 S 4MATIC+

VEHICLE TYPE: front-engine, all-wheel-drive, 5-passenger, 4-door sedan
BASE PRICE: $105,000 (est)
ENGINE TYPE: twin-turbocharged and intercooled DOHC 32-valve V-8, aluminum block and heads, direct fuel injection
DISPLACEMENT: 243 cu in, 3982 cc
POWER: 603 hp @ 6500 rpm
TORQUE: 627 lb-ft @ 2500 rpm
TRANSMISSION: 9-speed automatic with manual shifting mode

DIMENSIONS
WHEELBASE: 115.7 in
LENGTH: 196.6 in
WIDTH: 75.1 in
HEIGHT: 57.5 in
PASSENGER VOLUME: 98 cu ft
TRUNK VOLUME: 13 cu ft
CURB WEIGHT: 4500 lb

PERFORMANCE (*C/D* EST)
ZERO TO 60 MPH: 3.2 sec
ZERO TO 100 MPH: 7.8 sec
1/4-MILE: 11.5 sec
TOP SPEED: 186 mph

FUEL ECONOMY
EPA COMBINED/CITY/HWY: 19/17/23 mpg (*C/D* est)

historical highlight

HAMMER TIME

It's been 30 years since we first tested AMG's Hammer. Based on the E-class, it wore 17-inch wheels and a body kit worthy of *Miami Vice*, but it was no poseur. The Hammer packed a 355-hp 5.5-liter V-8 borrowed from an S-class with AMG-designed four-valve heads. This in an era when a BMW M5 made 256 horsepower and a Chevy Corvette made 240. It shot to 60 mph as quickly as a Ferrari Testarossa (5.0 seconds). Later Hammers would get even more power from a 6.0-liter V-8. Only a handful of Hammers made it to the States, but the supersedan made a strong enough impression that Mercedes signed an agreement to build production cars with AMG in 1990. In 1999, AMG became part of Mercedes-Benz, leading to today's 603-hp E63.

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WARRIOR — SUPER COUPON
29 PIECE TITANIUM NITRIDE COATED HIGH SPEED STEEL DRILL BIT SET
Customer Rating
ITEM 62281/61637 shown

SAVE 83%
SUPER COUPON $9.99
$19.99 comp at $59.98
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Limit 1 coupon per customer per day. Save 20% (25%) on any 1 item purchased. *Cannot be used with other discount, coupon or any of the following items or brands: Inside Track Club membership, Extended Service Plan, gift card, open box item, 3 day Parking Lot Sale item, compressors, floor jacks, saw mills, storage cabinets, chests or carts, trailers, trenchers, welders, Admiral, Bauer, CoverPro, Daytona, Earthquake, Hercules, Jupiter, Lynxx, Poulan, Predator, StormCat, Tailgator, Viking, Vulcan. Not valid on prior purchases. Non-transferable. Original coupon must be presented. Valid through 6/7/17.
42203598

PITTSBURGH AUTOMOTIVE — SUPER COUPON
RAPID PUMP® 3 TON LOW PROFILE HEAVY DUTY STEEL FLOOR JACK
ITEM 61282 shown 61253/62326
• Weighs 73 lbs.
Customer Rating
SAVE $190

SUPER COUPON $179.99
$99.99 comp at $269.99
42270709
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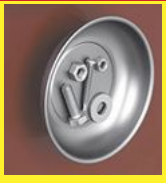
PITTSBURGH AUTOMOTIVE — SUPER COUPON
4" MAGNETIC PARTS HOLDER

SAVE 66%
Customer Rating
SUPER COUPON $1.99
ITEM 62535/90566 shown
$2.99 comp at $5.99
42191555
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HARDY — SUPER COUPON
POWDER-FREE NITRILE GLOVES PACK OF 100
SAVE 62%
Customer Rating
Item 68498 shown

SIZE	ITEM
MED	68496/61363
LG	68497/61360
X-LG	68498/61359

YOUR CHOICE $5.99
$7.99 comp at $15.99
• 5 mil thickness
42285277
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CENTRAL MACHINERY — SUPER COUPON
20 TON SHOP PRESS
• Pair of Arbor Plates Included
SAVE $220
Customer Rating

SUPER COUPON $149.99
$199.99 comp at $369.99
ITEM 32879 60603 shown
42195864
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CENTRALPNEUMATIC — SUPER COUPON
SAVE 59%
3 GALLON, 100 PSI OILLESS AIR COMPRESSORS
A. HOT DOG
ITEM 69269/97080 shown

B. PANCAKE
ITEM 95275 shown 60637/61615

Customer Rating
YOUR CHOICE $39.99
$59.99 comp at $98.62
42286664
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HaulMaster — SUPER COUPON
• 1000 lb. capacity
MOVER'S DOLLY
ITEM 60497/93888 shown 61899/62399/63095/63096 63098/63097

SAVE 59%
SUPER COUPON $7.99
Customer Rating
$19.99 comp at $19.97
42255761
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CENTRALPNEUMATIC — SUPER COUPON
1/4" AIR ANGLE DIE GRINDER
Customer Rating
ITEM 62439/69945/32046 shown

SAVE 85%
SUPER COUPON $9.99
$14.99 comp at $69.98
42201267
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PITTSBURGH — SUPER COUPON
9 PIECE FULLY POLISHED COMBINATION WRENCH SETS
Customer Rating
SAE
ITEM 69043/63282/42304 shown
SAVE 59%
METRIC
ITEM 42305/69044/63171

YOUR CHOICE $5.99
$8.99 comp at $14.97
42259076
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CENTRALPNEUMATIC — SUPER COUPON
SAVE $138
RETRACTABLE AIR HOSE REEL WITH 3/8" x 50 FT. HOSE
ITEM 93897 shown 69265/62344

SUPER COUPON $59.99
$89.99 comp at $198.45
Customer Rating
42259456
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SUPER COUPON
SAVE 64%
7 FT. 4" x 9 FT. 6" ALL PURPOSE WEATHER RESISTANT TARP

Customer Rating
ITEM 69249/69115/69137 69129/69121/877 shown
SUPER COUPON $2.99
$4.99 comp at $8.48
42258846
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PITTSBURGH — SUPER COUPON
130 PIECE TOOL KIT WITH CASE
ITEM 63091 63248/68998 shown

SUPER COUPON $29.99
Customer Rating
SAVE $76
$39.99 comp at $106.34
42233243
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drillmaster — SUPER COUPON
1500 WATT DUAL TEMPERATURE HEAT GUN (572°/1112°)
Customer Rating

SAVE 68%
ITEM 62340 62546/63104 96289 shown
SUPER COUPON $8.99
$14.99 comp at $28.83
42238687
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PITTSBURGH AUTOMOTIVE — SUPER COUPON
2 PIECE VEHICLE WHEEL DOLLIES
ITEM 60343/67338 shown
Customer Rating

SAVE 44%
SUPER COUPON $49.99
• 1500 lb. capacity
$59.99 comp at $89.99
42222091
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US GENERAL — SUPER COUPON
26", 4 DRAWER TOOL CART
ITEM 95659 shown 61634/61952
SAVE $269

SUPER COUPON $99.99
$149.99 comp at $369.32
Customer Rating
• 580 lb. capacity
42237030
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US GENERAL PRO — SUPER COUPON

26", 16 DRAWER ROLLER CABINET

ITEM 61609/67831 shown

- 14,600 cu. in. of storage
- 1060 lb. capacity

SAVE $653

SUPER COUPON $299.99

comp at $952.99

Customer Rating ★★★★★

42353790

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7 FUNCTION DIGITAL MULTIMETER

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$16.45 VALUE

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42350690

CEN-TECH — SUPER COUPON

AUTOMATIC BATTERY FLOAT CHARGER

ITEM 69594 69955 42292 shown

SAVE 85%

SUPER COUPON $4.99

Customer Rating ★★★★½

comp at $34.99 ~~$8.99~~

42377879

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CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON

Customer Rating ★★★★½

RECIPROCATING SAW WITH ROTATING HANDLE

SAVE 59%

SUPER COUPON $19.99

ITEM 61884

62370/65570 shown

comp at $49.97 ~~$27.99~~

42313476

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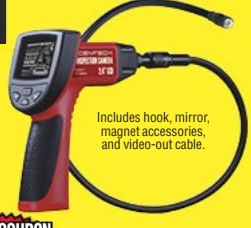
CEN-TECH — SUPER COUPON

ITEM 61839

62359 shown

2.4" COLOR LCD DIGITAL INSPECTION CAMERA

SAVE $135



Includes hook, mirror, magnet accessories, and video-out cable.

SUPER COUPON $69.99

Customer Rating ★★★★½

comp at $205.75 ~~$79.99~~

42300028

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COVERPRO — SUPER COUPON

Customer Rating ★★★★½

10 FT. x 20 FT. PORTABLE CAR CANOPY

NEW

ITEM 63054/60728

69034/62858 shown

SAVE $106

SUPER COUPON $99.99

comp at $205.99 ~~$149.99~~

42350504

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Haul Master — SUPER COUPON

Customer Rating ★★★★½

4 PIECE 1" x 15 FT. RATCHETING TIE DOWNS

ITEM 63056/63057/60405/63094 63150/61524/62322/90984 shown

SAVE 80%

SUPER COUPON $6.99

comp at $34.95 ~~$11.99~~

42301106

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CEN-TECH — SUPER COUPON

ITEM 60581

60653 shown

SAVE 57%

12 VOLT, 10/2/50 AMP BATTERY CHARGER/ ENGINE STARTER

SUPER COUPON $29.99

Customer Rating ★★★½☆

comp at $69.99 ~~$49.99~~

42324390

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CHICAGO ELECTRIC WELDING — SUPER COUPON

- No Gas Required

SAVE $50

120 AMP FLUX WIRE WELDER

ITEM 61849/62719 68887 shown

Customer Rating ★★★★½

SUPER COUPON $99.99

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PITTSBURGH — SUPER COUPON

Customer Rating ★★★★

6" DIGITAL CALIPER

ITEM 61585 62387 47257 shown

SUPER COUPON $9.99

SAVE 66%

- SAE and metric

Includes two 1.5V SR44 button cell batteries.

comp at $29.99 ~~$17.99~~

ITEM 60581/60653 shown

42296420

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BADLAND — SUPER COUPON

Customer Rating ★★★★½

2500 LB. ELECTRIC WINCH WITH WIRELESS REMOTE CONTROL

SAVE $70

ITEM 61840/61258 shown 68146/61297/63476

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Customer Rating ★★★★½

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NEW

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CENTRAL PNEUMATIC

20 OZ. GRAVITY FEED SPRAY GUN

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drill master — SUPER COUPON

ITEM 69651 62868/62873 68239 shown

Customer Rating ★★★★½

18 VOLT CORDLESS 3/8" DRILL/DRIVER WITH KEYLESS CHUCK

SAVE 65%

Includes one 18V NiCd battery and charger.

SUPER COUPON $16.99

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Customer Rating ★★★★★

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SAVE 71%

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SUPER COUPON $2.99

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12" SLIDING COMPOUND DOUBLE-BEVEL MITER SAW WITH LASER GUIDE

ITEM 61969/61970/69684 shown

Customer Rating ★★★★½

SUPER COUPON $134.99

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comp at $339 ~~$199.99~~

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High-Toned Hoosier

Subaru's former runt, the **Impreza**, strives to be an Asian Audi built in America. _by Aaron Robinson

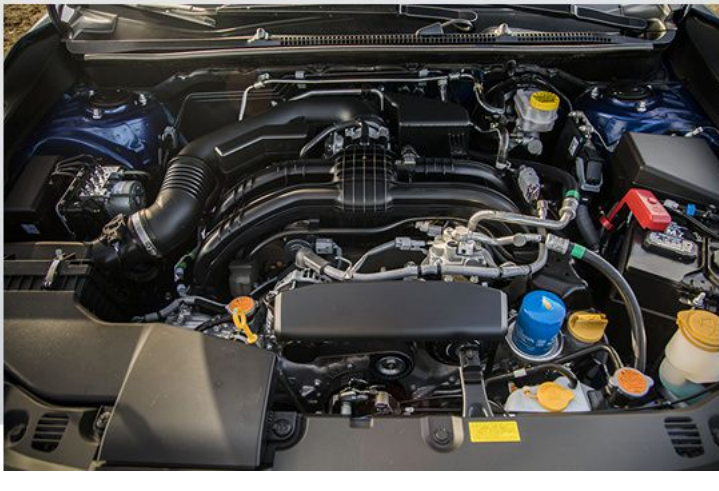
SUBARU IS AN ODD COMPANY in so many ways. One is its ratio of sedan to wagon sales; it is pretty much the opposite of every other carmaker. Take the Impreza, which sells at a rate of 30 percent sedans to 70 percent wagons—or, to use the preferred industry terminology, "five-doors." Honda, for instance, expects the new Civic hatch to make up only about 15 percent of overall Civic sales.

No doubt, Subaru has had some very good years. Annual sales zoomed up right through the recession to the current 600,000 mark, and Subaru hasn't squandered the profits on booze and dice. Instead, it has plowed a significant pile into an all-new, soon-to-be-ubiquitous architecture given the sexy name of Subaru Global Platform. U.S. Imprezas will be built in Indiana. We're told that 95 percent of the Impreza is new, from the curved skeletal members baked into the floor and designed to better handle impact pulses to the super-stiff hard points at the bases of the A-pillars that laugh at the small-overlap crash test to the stouter yet no heavier suspension subframes to the flowing new exterior lines.

The exterior and interior designs won't win any The Future Is Now awards, but they do pull Subaru into the modern era, especially inside with three multicolor screens upon which the latest apps run plus an optional navigation system based on TomTom software and an optional rocking Harman/Kardon stereo. The upholstery trim gets noticeably nicer as you move from the base 2.0i up to the Premium, Sport, and Limited trims, where the cockpit detailing is a big step forward for Subaru's cheapest car.

[+] Sized and priced right, handles like a BRZ with rear doors. [–] Not the most adventurous styling, manual still a five-speed.

Subaru has wanted to push the Impreza up the social scale ever since it stopped offering blue paint with gold wheels on the WRX STi. The past is the past, and Subaru wants the all-wheel-drive-only Impreza to be thought of not as a hooligan's proto-rally car but as a cut-price Audi, with dynamic sophistication to match. All the pieces



haven't really fallen into place until now, bedeviled as the Impreza was by chintzy no-brand electronics and a bargain-budget feel.

Now, with a stiff new platform, a stick shift offered even in the upper Sport trim, more sound insulation, and a heating/air-conditioning system redesigned to be quieter, the Impreza is gunning to be a serious challenger to the Honda Civic and Mazda 3. With a price escalator that starts at $19,215 for the base 2.0i manual sedan and ends at the $25,415 Limited CVT hatchback, the Impreza matches up nicely against the two compacts we consider good alternatives for those who can't or won't pay for an Audi A3.

Rated at 152 horsepower at 6000 rpm and 145 pound-feet of torque at 4000 rpm, the peaky, naturally aspirated 2.0 is not exactly ate up with power despite its lofty 12.5:1 compression ratio. The power ratings are about on par with the other base compact-class engines in the competitors, though, unlike Honda and Mazda, Subaru does not (yet) offer an upgrade engine as you climb the Impreza's trim levels. This one 2.0 is what you get, though the revised FB20 does seem a smidge more refined and smoother than boxers of yore. Perhaps it's just the new Impreza's additional sound insulation. But after they *chugga-chugga-chugga* to life in that particular loping Subaru way, the four flat pots sound good and healthy and have a taste for revs, which you'll need if you wish to ascend hills with any sort of alacrity.

The five-speed manual (ugh, still!) was delayed a couple of months, so a CVT was what we jockeyed around the hinterlands east of San Diego. As at Honda, the Subaru CVT mimics a step-gear transmission at higher throttle inputs, revving up and then "shifting" to a new, taller ratio. Most owners will never know it's a CVT, and it does an excellent job keeping the engine in the fattest part of its somewhat lean torque band.

Where the Impreza really starts to feel Audi-like is in the corners. A heavily rethought electrically assisted power-steering unit takes the ratio down from 16:1 in the old car to 13:1, the same as the BRZ's. The quicker steering combined with sophisticated damping that clips the body motion and also soaks up the impacts with a tolerant compliance proves again that, as with the BRZ, the Subaru boys know how to tune a suspension.

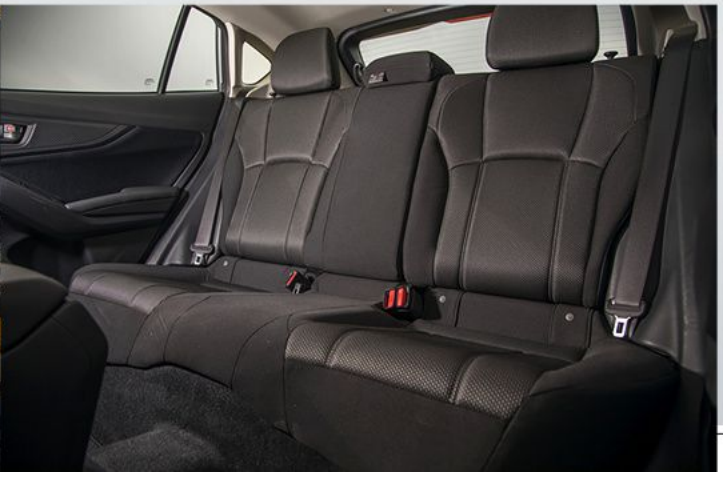
Steering response and on-center certainty were big focal points in the platform's development, and Subaru trotted out several charts to proudly prove their success. Well, the Impreza is not just a paper tiger; the steering wheel feels awake in your hands, and the car scribes neat, clean lines through the apexes. Brake-based torque vectoring on the Sport trim only heightens the car's eagerness to turn and undoubtedly cuts the understeer inherent in most all-wheel-drivers pushed to the limit.

The new Impreza's interior is roomier, finished in higher-quality materials, and better shielded from noise than the old car's.

Much of the Impreza's incremental growth goes toward making the cabin larger. It is 1.1 inches wider for the front seaters, whose chairs move farther apart, and 1.4 inches wider for the rear, the wheelbase growing an inch to increase legroom in back. The rear shock towers are pushed farther apart to make some room in the trunk, and the rear doors have larger apertures. The upsizing brings it to within a hair of the Civic's dimensions.

In a hatch, it's all about the hole, and Subaru widened the Impreza's by splitting up the taillights and putting part of each lens on the cargo door. Subaru claims three more cubic feet of cargo space in the wagon than previously, or enough to pack in 2472 ears of corn with the seats down. Really, the Subaru folk actually made glued-up corn sculptures—corn being a leading export of Indiana—in the shape of the wagon's cargo area to prove it. Because Subaru.

Oddly for a company with such a great sporting history, the company wants to be thought of first and foremost as the safety choice, which is why EyeSight, Subaru's own suite of automated safety systems including adaptive cruise control and pre-collision braking, features prominently in the Impreza's press bumf. Apparently, Subaru's growing legions of followers say safety is a big reason they buy the all-wheel-drive cars, along with reliability and good resale value. Whatever the reasons, it seems to be working for Subaru.



2017 SUBARU IMPREZA

VEHICLE TYPE: front-engine, all-wheel-drive, 5-passenger, 4-door sedan or hatchback
BASE PRICE: $19,215–$25,415
ENGINE TYPE: DOHC 16-valve flat-4, aluminum block and heads, direct fuel injection
DISPLACEMENT: 122 cu in, 1995 cc
POWER: 152 hp @ 6000 rpm
TORQUE: 145 lb-ft @ 4000 rpm
TRANSMISSIONS: 5-speed manual, continuously variable automatic with manual shifting mode

DIMENSIONS
WHEELBASE: 105.1 in
LENGTH: 175.6–182.1 in
WIDTH: 70.0 in
HEIGHT: 57.3 in
PASSENGER VOLUME: 97–100 cu ft
CARGO VOLUME: 12–21 cu ft
CURB WEIGHT: 3050–3150 lb

PERFORMANCE (*C/D* EST)
ZERO TO 60 MPH: 8.2–8.8 sec
ZERO TO 100 MPH: 25.3–26.5 sec
1/4-MILE: 16.5–16.9 sec
TOP SPEED: 120 mph

FUEL ECONOMY
EPA COMBINED/CITY/HWY: 27–32/24–28/31–38 mpg (*C/D* est)

TESTED

M Who?

Alpina's **B7** is BMW's quickest vehicle.
_by Alexander Stoklosa

[+] Extreme quickness, capable handling, near bargain price. [–] Should be inducted as a full-blown M car.

IN THE EARLY 1960S, Burkard Bovensiepen found escape from his family's German typewriter-manufacturing business by affixing hotter carbs in BMWs. Stealing the Alpina name from the typewriter outfit, he earned racing success and developed a sort of clairvoyance, anticipating high-performance BMWs before BMW did, starting with the more powerful Alpina 1500 and 1600 sedans, which predated the factory 1800 and iconic 2002.

Alpina left racing at the end of the 1977 season to begin its road-car operations with mightier 3-, 5-, and 6-series models (again, effectively presaging BMW's own M3, M5, and M6) just as BMW's big new 7-series made its debut. BMW never built an M7, perhaps because Alpina built its own 7-based creations. However, they were never really what an M7 might have been; too calm and stoic for the Motorsport badge. At least, not until now. After an onslaught of increasingly technical and tense M sedans, the 2017 B7, Alpina's latest hot-rod 7-series, feels to us like what the biggest M car should be.

The all-wheel-drive B7 conjures some M fumes underhood with its twin-turbo 4.4-liter V-8 from the 750i fortified with Mahle pistons, a special exhaust, larger turbochargers pushing up to 20.0 psi of boost, and an Alpina intake and intercooler arrangement. The resulting 600 horsepower and 590 pound-feet of torque, 155 ponies and 110 pound-feet stronger than stock, match exactly the output of the forthcoming 12-cylinder M760i, BMW's first M-badged 7-series. Yet again, Alpina gives us a glimpse of the future.

Here is enough power to rank the B7 as the quickest dealership-sold BMW we've ever tested, with 60 mph arriving in 3.4 seconds and the quarter-mile smoked like a robusto at the end of a Dyson vacuum: 11.6 seconds at 122 mph. The claimed top speed is 193 mph, in case you drive a lot of empty autobahns. A far more practical talent is the B7's high-speed stability as it effortlessly sneaks up on triple-digit velocities between speed traps.

Making the most of the 600 horsepower is the excellent ZF eight-speed automatic borrowed from the 7-series and given more aggressive shift mapping here. Uncork its full magnificence using the signature Alpina shift buttons on the back of the steering wheel, which are not paddles but hidden nubs wrapped in the same leather as the rest of the rim. Kinky.

There's nothing deviant about the B7's air-sprung suspension, which is tuned for maximum grip and comfort, a combo fast fading from the BMW M portfolio. Delivering its potent neutral handling and 0.97 g without riding as if the suspension, the large-diameter wheels, and the rubber-band-thin tires are locked in a struggle, the Alpina limo manages to outshine not only every contemporary M car but every mainstream BMW in this regard.

Outrunning all large sedans save for the Audi S8 Plus and the Tesla Model S, boasting exclusive Alpina flourishes, and channeling the core competencies of late BMW M cars we miss all amply justify the B7's $137,995 base price. It's worth even more, we'd say. And it would make one hell of an M7—or, at least, a helpful, 206.7-inch-long arrow pointing the way back to the Ultimate Driving Machines that BMW's M division could (and should) still be building.

7UP
For the B7, Alpina fits bigger turbos (puffing up to 20.0 psi of boost) plus new intake and exhaust systems to BMW's 4.4-liter V-8 to create a V-12–rivaling 600 horses and acceleration unrivaled by any BMW.

2017 BMW ALPINA B7 xDRIVE

VEHICLE TYPE: front-engine, all-wheel-drive, 5-passenger, 4-door sedan
PRICE AS TESTED: $156,445
BASE PRICE: $137,995
ENGINE TYPE: twin-turbocharged and intercooled DOHC 32-valve V-8, aluminum block and heads, direct fuel injection
DISPLACEMENT: 268 cu in, 4395 cc
POWER: 600 hp @ 6250 rpm
TORQUE: 590 lb-ft @ 3000 rpm
TRANSMISSION: 8-speed automatic with manual shifting mode
DIMENSIONS
WHEELBASE: 126.4 in
LENGTH: 206.7 in
WIDTH: 74.9 in
HEIGHT: 58.7 in
PASSENGER VOLUME: 115 cu ft
TRUNK VOLUME: 18 cu ft
CURB WEIGHT: 4899 lb

C/D TEST RESULTS

ZERO TO 60 MPH: 3.4 sec
ZERO TO 100 MPH: 7.8 sec
ZERO TO 170 MPH: 26.6 sec
ROLLING START, 5–60 MPH: 4.3 sec
1/4-MILE: 11.6 sec @ 122 mph
TOP SPEED: 193 mph (mfr's claim)
BRAKING, 70–0 MPH: 151 ft
ROADHOLDING, 300-FT-DIA SKIDPAD: 0.97 g
FUEL ECONOMY
EPA COMBINED/CITY/HWY: 18/16/24 mpg
***C/D* OBSERVED:** 19 mpg

Shell V-Power NiTRO+ Premium Gasoline
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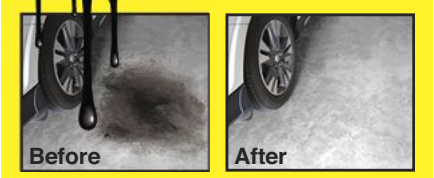

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Tech Warrior

Wider, lighter, and more powerful than the GT S, Mercedes-AMG's **GT R** also turns up the tech. _by Josh Jacquot

BERND SCHNEIDER DOESN'T CARE. He doesn't care that every fiber of our being knows he should have started braking 100 feet earlier. He doesn't care about road-racing conventions. But most importantly, he doesn't care about physics. Because he doesn't have to. Mercedes-AMG's latest track special, the GT R, does that for him.

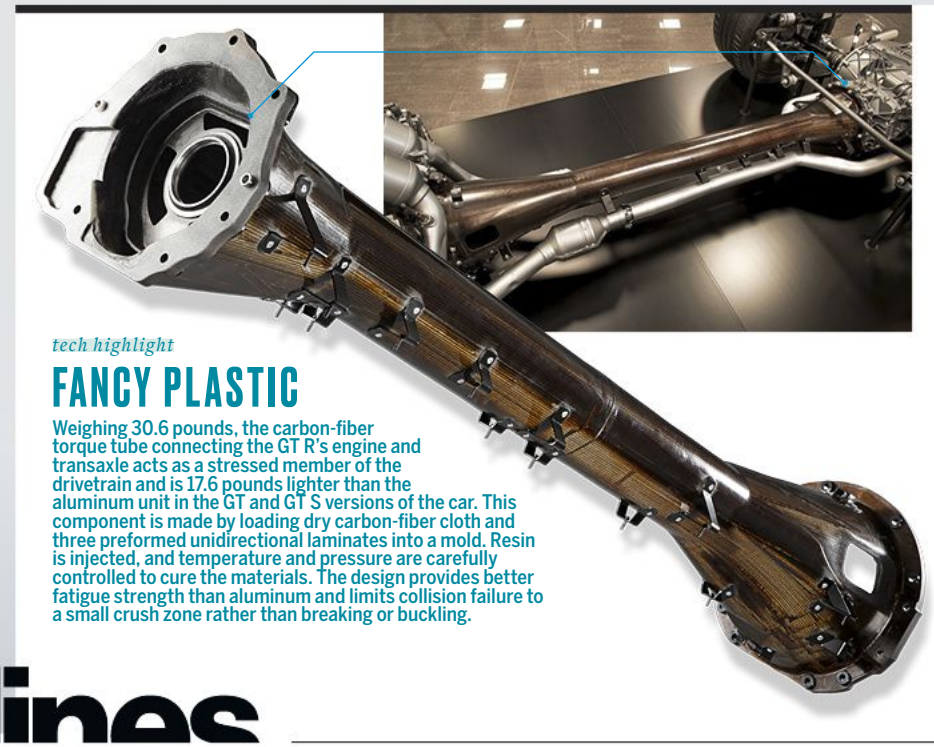
Entering an off-camber, 180-degree left on the Algarve International Circuit near Portimão, Portugal, the five-time DTM champion grenades the brake pedal with his left foot, instantly sending the chassis into convulsive ABS fits. With the car writhing for longitudinal grip, he cranks the wheel in a seemingly vain attempt to dive for the apex. Somehow, though, it works, the ABS trilling in overtime. And with his right foot still partially committed to the throttle, the GT R turns. As the apex nears, Schneider releases the brake and mats the throttle, relying on the GT R's advanced traction control to deliver power to the ground. There is no subtlety here, no consideration given to separating braking, steering, and throttle inputs, no concern for traditional technique. Rather, this is a wholesale commitment to go-fast technology, and it requires stones. The GT R delivers the former; the latter is up to you.

Schneider, who steps in only for high-level track development at AMG, reveals a level of heretofore unseen progress. The inclusion of left-foot braking and brake/throttle overlap abilities into the GT R's powertrain and stability-control calibration demonstrates that the team at AMG isn't just fooling around with track driving. They're seeking speed, convention be damned.

[+] Pull-the-chute braking stability, encourages a good caning, wider is better. [–] Commitment required to achieve greatness, tech detracts from driving experience.

Don't think of the GT R as a GT S with its boost cranked up. This is a comprehensive revision to make an already fast car even faster. Being a longtime purveyor of excess horsepower, AMG's greatest strength still lies underneath the hood, where its twin-turbocharged 4.0-liter V-8 resides. At 577 horsepower and 516 pound-feet of torque, the GT R's dry-sump powerplant produces 74 horsepower and 37 pound-feet of torque more than the GT S model. Boost, which rises from 17.4 to 19.6 psi, is a big part of that equation. A drop in compression from 10.5:1 to 9.5:1 accommodates the boost increase. The Borg-Warner turbochargers housed in the engine's valley get bigger compressor wheels, and the cylinder heads' exhaust ports get milled to improve flow.

The rear-mounted transaxle, incorporating an electronically controlled limited-slip differential, has the same basic seven-speed dual-clutch gearbox used in



tech highlight

FANCY PLASTIC

Weighing 30.6 pounds, the carbon-fiber torque tube connecting the GT R's engine and transaxle acts as a stressed member of the drivetrain and is 17.6 pounds lighter than the aluminum unit in the GT and GT S versions of the car. This component is made by loading dry carbon-fiber cloth and three preformed unidirectional laminates into a mold. Resin is injected, and temperature and pressure are carefully controlled to cure the materials. The design provides better fatigue strength than aluminum and limits collision failure to a small crush zone rather than breaking or buckling.

the GT and GT S models. But its ratios tighten, which allows the driver to drop into the lowest cog in tight corners. The final drive is shorter at 3.88 versus the GT S's 3.67 ratio.

Considerable expenditure went toward lightening the GT R. The roof, the adjustable wing, the front splitter, the rear diffuser, and the front fenders are carbon fiber, as are three underbody braces and the torque tube connecting the engine and transaxle [see tech highlight]. Carbon-ceramic brake rotors (15.8 inches front, 14.2 inches rear) are optional and come with six-piston fixed front calipers.

However, the addition of an active front splitter, grille shutters, and rear-wheel steering nets only a 33-pound reduction. Expect the GT R to hit the scales at about 3650 pounds—not light for a car meant to challenge the best from Weissach and, let's be honest, Bowling Green.

Those carbon-fiber front fenders cover a 1.8-inch-wider front track while the rear track increases 2.3 inches over the GT S. The forged aluminum wheels increase one inch in width at both ends (10 x 19 front, 12 x 20 rear), too. Confirming its status as a track-day special are Michelin Pilot Sport Cup 2 tires.

Adjustability is a key component of the GT R's personality. Height-adjustable coilovers at every corner allow for ride-height tweaks and corner balancing—should GT R owners be so ambitious. Inside, the chassis and powertrain response get tuned via five drive modes: individual, comfort, sport, sport-plus, and race. Separate buttons for the dampers (two positions), the exhaust, the transmission's manual shifting mode, and the stability control allow direct tuning of the car even once it's committed to a particular setting. But it's the addition of a nine-position traction-control system managed by a center-dash knob that is the most important tunability upgrade from lesser models.

Switching off the stability control activates this traction-control playscape, though it seemingly lacks the elegance of some competitors' systems. The power oversteer is managed, sure, but the system's abrupt halt to even modest slip angles sometimes interrupts the flow of a well-executed corner exit. We never tried its most aggressive (i.e., lenient) setting, however, so the verdict, for now, is still out. Chevy's Performance Traction Management offers similar control but with more discriminate intervention, allowing the tail to subtly step out before modestly reeling it back in.

The GT R's traction control has nine positions. If AMG goes for 10, it might have to barf up a lung.

Despite our very brief drive, several things became clear: Otherworldly braking is likely the GT R's greatest asset. Not just braking, in fact, but braking while turning—the technique that Schneider endorses as quickest. The addition of rear-wheel steering, which works with the quicker variable-ratio rack up front, relieves the front tires of some turning work during heavy braking, when they most need the help. Below 62 mph, the rear wheels turn opposite the fronts, and above that speed they turn in the same direction—up to a maximum of 1.5 degrees. A new calibration for the limited-slip diff aids in controlling yaw during heavy braking. Even if you've switched it off, the stability-control system remains an ever-present Hand of God during braking.

It's virtually certain that the GT R will prove itself to be among the world's quickest production track cars when it goes on sale later this year. Lap times, however, aren't the sole measure of a great driver's car. Driving fulfillment is a product of many factors—some tangible, some not. Whether the GT R's electronic aids, which make it highly controllable at the raw edge of grip, diminish the driving experience remains to be seen.

Schneider, we'd bet, still won't care.

2018 MERCEDES-AMG GT R

VEHICLE TYPE: front-engine, rear-wheel-drive, 2-passenger, 2-door coupe
BASE PRICE: $199,000 (est)
ENGINE TYPE: twin-turbocharged and intercooled DOHC 32-valve V-8, aluminum block and heads, direct fuel injection
DISPLACEMENT: 243 cu in, 3982 cc
POWER: 577 hp @ 6250 rpm
TORQUE: 516 lb-ft @ 1900 rpm
TRANSMISSION: 7-speed dual-clutch automatic with manual shifting mode
DIMENSIONS
WHEELBASE: 103.5 in
LENGTH: 179.2 in
WIDTH: 79.0 in
HEIGHT: 50.6 in
TRUNK VOLUME: 12 cu ft
CURB WEIGHT: 3650 lb
PERFORMANCE (*C/D* EST)
ZERO TO 60 MPH: 2.9 sec
ZERO TO 100 MPH: 6.7 sec
1/4-MILE: 11.1 sec
TOP SPEED: 198 mph
FUEL ECONOMY
EPA COMBINED/CITY/HWY: 17/15/21 mpg (*C/D* est)

TESTED

Pushing Dope

After decades of trying, pushrods finally improve the Miata. This is **Flyin' Miata's** 525-hp LS-powered freak. _by John Pearley Huffman

PERVERSION IS THE ESSENCE of American culture. It's taking something built for one purpose and supercharging the designers' original intent, often literally. It's a 1953 Studebaker Champion that goes 249 mph, or a 1975 Ford F-250 with flotation tires that crosses rivers and crushes cars. It's taking a small country's agrarian, 18th-century constitution and growing an industrial, transcontinental 21st-century superpower under it. So here, in the tradition of land-speed-record Studes, the Bigfoot monster truck, and *Marbury v. Madison*, comes Flyin' Miata's 2016 MX-5 with a stonkin' V-8 in its nose.

Cramming V-8s into MX-5 Miatas is now a classic American handicraft. Since way back in the early 1990s, Americans have been shoving Ford and GM small-blocks into the otherwise unassuming Mazda roadsters. The problem is that iron-block lumps designed to power Crown Vics and Caprices play havoc on a Miata's balance. Dive into a corner with one of those nose-heavy squids and it pirouettes like Oksana Baiul on an all-night bender.

Two things radically improve the V-8 Miata formula. First is the availability of the compact, lightweight, aluminum LS-series GM V-8 crate engines. And second is the introduction of the latest ND-generation Miata.

Flyin' Miata bolts the LS376/525 version of the 6.2-liter naturally aspirated V-8 into this ND and nicknames its creation, appropriately enough, the Habu, after a species of Japanese pit viper. Rated at 525 horsepower at 6200 rpm, it's basically the LS3 from the fifth-generation Camaro SS (normally a 430-hp affair) but with a camshaft developed for use in American Speed Association (ASA) stock-car racing. With longer duration and greater lift, the ASA cam makes more power and gives the engine a nasty, loping, Pro-Stock growl at idle. It also has a wicked, charismatic, Cup-Car snarl under load.

[+] Sciatica-squeezing driving experience, all the Miata is not lost, didn't break. [–] Much restraint required, persistent warning lights, looks like any other Miata.

tech highlight

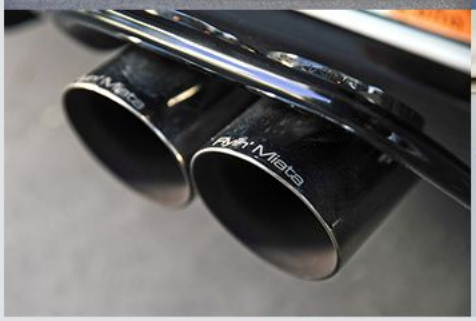
FOUND IN TRANSLATION

Here's the problem: The Miata's many computers speak Mazda and the LS376 V-8's engine control computer only understands GM. "The reverse lights go through three separate modules before they can be turned on," says Flyin' Miata's Keith Tanner. And neither GM nor Mazda likes to share its computer language. So Flyin' Miata adds an intermediary—a controller area network (CAN) computer—built by Germany's MRS Electronic to translate between the GM and Mazda hardware. "Most of the translation is done in the MRS CAN module, but a little bit of the GM code is modified," explains Tanner. It is, however, still a work in progress as a few warning lights remain lit on the V-8 Miata's otherwise unmodified instrument panel.

Notable progress exists as a result of FM's eight years of work on the V-8 Miatas. For instance, earlier Miatas used a GM throttle pedal that is included in GM's E-Rod crate-engine conversion kit, but the ND Miata retains the Mazda pedal. "We're still working on it," concludes Tanner. "We want to get rid of all those [warning] lights."

Drivelines

photography by SCOTT G. TOEPFER



Mazda designed the ND Miata to be lighter, but it also has a roomier engine bay that accommodates the V-8 with relative ease. It's also the best-handling Miata ever, and its wheel wells will accept larger footwear. In other words, the ND is as close to being an ideal V-8 transplant recipient as any car since the 1962 AC Ace.

Still, the ND needs fortification to survive the V-8's onslaught. So the Mazda transmission is ditched in favor of the familiar Tremec T-56 six-speed manual. A new aluminum driveshaft leads to a rear differential also swiped from a fifth-generation Camaro SS. Up front, a hydraulic steering rack from a Camaro replaces the electrically assisted Mazda rack. Somehow, Flyin' Miata snakes a true dual exhaust with twin transverse mufflers in there as well. So, basically, it's a Miata that swallowed a Camaro.

At 2696 pounds, this V-8 Miata weighs 380 pounds more than the last stock 2016 Miata we tested. The stock MX-5 puts 51.9 percent of its weight on the front wheels, where the Habu has 53.0 percent.

Is a Miata still a Miata if it doesn't have Miata steering or a Miata shifter? No. The Habu is, instead, proof that the Cobra formula is still perversely appealing.

Start the V-8, and the sound is so herculean that it nearly ripples the Miata's sheetmetal as the car rocks side to side in sync with the cam lobes. It's fitted with an LS7 clutch and flywheel, but the pedal action isn't heavy and the engagement is smooth. Dipping into the throttle is as satisfying as jumping on a Stomp Rocket.

Even with a gentle leave at 1100 to 1200 rpm, the engine utterly overwhelms the Miata. The entire car constricts around you, a massive crush of torque squeezing the air out of your lungs and cracking the lower vertebrae of your back. The 245/40R-17 Bridgestone Potenza RE71R tires bark under the onslaught, and the roadster thunders to 60 mph in 3.5 seconds. Hold on a bit longer, and the quarter-mile is consumed in 11.7 seconds at 123 mph. Chevrolet's 2017 Corvette Grand Sport needs 3.8 seconds to reach 60 mph and 12.2 to get through the quarter-mile. A Corvette Z06 coupe will run a couple tenths quicker than the Habu, but it feels like a pillow compared with the raw-nerve V-8 MX-5.

The Flyin' V-8 reaches 60 mph 2.7 seconds quicker than a stock Miata and runs through the quarter-mile 3.1 seconds quicker. In the 18.2 seconds it takes the stock Miata to reach 100 mph, the LS-powered car is already approaching 150 mph. This is lurid, indecent, and practically pornographic acceleration.

Like a proper aftermarket speed pusher, Flyin' Miata throws its catalog of go-fast/stop-fast products on this car. And with all the FM suspension bits, reinforced halfshafts, and oversized brakes, the V-8 car is tractable, stable, and manageable. The understeer is subdued, and the on-demand oversteer is well modulated. It can be driven just like a regular car, even if the stock stability control is disabled. "This is a high power-to-weight-ratio car; don't drive it like an idiot," warned FM's Keith Tanner, as if idiocy wasn't a requirement for wanting one.

Flyin' Miata LS V-8 conversions start at $49,995 plus a Miata. The total chit for this car is $85,301, including $30,900 for the base Mazda GT. Not cheap, but if Carroll Shelby's name were on the car, it would be a bargain.

Thank God for the perverts who keep America great.

2016 FLYIN' MIATA HABU

VEHICLE TYPE: front-engine, rear-wheel-drive, 2-passenger, 2-door convertible
PRICE AS TESTED: $85,301
BASE PRICE: $80,895*
ENGINE TYPE: pushrod 16-valve V-8, aluminum block and heads, port fuel injection
DISPLACEMENT: 376 cu in, 6162 cc
POWER: 525 hp @ 6200 rpm
TORQUE: 486 lb-ft @ 5200 rpm
TRANSMISSION: 6-speed manual

DIMENSIONS
WHEELBASE: 90.9 in
LENGTH: 154.1 in
WIDTH: 68.3 in
HEIGHT: 48.8 in
PASSENGER VOLUME: 49 cu ft
TRUNK VOLUME: 5 cu ft
CURB WEIGHT: 2696 lb

C/D TEST RESULTS

ZERO TO 60 MPH: 3.5 sec
ZERO TO 100 MPH: 7.8 sec
ZERO TO 150 MPH: 18.7 sec
ROLLING START, 5–60 MPH: 3.9 sec
1/4-MILE: 11.7 sec @ 123 mph
BRAKING, 70–0 MPH: 148 ft
ROADHOLDING, 300-FT-DIA SKIDPAD: 1.07 g

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What I'd Do Differently
Andy Palmer, 53

Aston Martin's CEO discusses his love of punk rock, working his way up from the bottom, and why he left Nissan to take the reins at a relative minnow.

► *interview by* MIKE DUFF

C/D: ***Did you really leave school at the age of 16?***

AP: Yes. I didn't really understand what an engineer was, but I knew I wanted to be in the car business; I loved stripping down old engines. The quickest route was through an apprenticeship, so at 16 I quit school and started to work for Automotive Products—AP—here in the U.K.

■ ***And you were into punk rock?***

☐ I still am, to be honest; it's the music of my youth. I was listening to the Stranglers on my way here, and when I'm driving my 1980 V-8 Vantage, there's nothing better than having a Boomtown Rats cassette in the original player. It takes me back to when I had spiky hair and drank too much.

■ ***Why did you specialize as a transmission engineer?***

☐ I think it chose me as much as I chose it. I've always loved gearboxes. I collect books on making watches, and when I retire that's what I'm going to do, make watches and clocks. It's very similar, using gearing to reduce or increase force. In my early days at AP I got to work on what were the first dual-clutch transmissions, but with analog electronics they weren't very good.

■ ***Nissan moved to the widespread adoption of CVTs on your watch. Are you going to apologize for that?***

☐ Not at all—it's horses for courses. For many cars, a CVT is the best solution. Not for Aston Martins, of course, but I'm keen to always have two extremes in our transmissions—a slick automatic at one end and a proper manual 'box at the other. We will keep making manual 'boxes for as long as anyone wants to buy them.

■ ***What is Carlos Ghosn like when the cameras stop rolling?***

☐ He's a remarkable guy—you have to be to get where he is. He's calm and logical and has the ability to ask exactly the right question at the right time. He's also got the knack for persuading people. You'd go into a meeting thinking something was impossible and then leave convinced you could do it.

■ ***Having nearly reached the top at Nissan, it must have been hard to leave, even to head up Aston Martin?***

☐ In some ways it was, but in others it was easy. I was 50 years old and enjoying what I was doing at Nissan. I love cars, I had a huge budget, and we were developing 10 new models a year. But I was also kidding myself. I wasn't where I wanted to be; I wanted to be leading a company. Aston's call really woke me up. Call it a midlife crisis or a reality check, but I thought, "I'm never going to be CEO of Nissan or Renault," and then the decision became easy.

■ ***What did you find when you arrived?***

☐ Lots of passion, but the company hadn't had a CEO for 18 months and was a bit rudderless. The first thing I did was put a plan together, then we had to go out and get investment to pay for it. It was only when the money was in the bank that people started to realize something was different. We didn't just have funding for one new car, but four new cars and two specials every year. Then people started to get excited.

■ ***One of those cars is an electric vehicle. Do you really think the world is ready for an Aston Martin EV?***

☐ Absolutely! When I first came in, I made it clear I thought the world was moving electric, based on my previous experience, and I would say that I was in a minority of one on that one. But the world is changing rapidly—we've had Dieselgate and Tesla, and now Porsche and Jaguar are developing their own electric vehicles. Suddenly everybody is starting to realize it's the future.

■ ***You once pointed out that Aston has only made a profit in two years of its 103-year history. How do you change that?***

☐ It's not just about making money, although we have to do that. It's about ensuring the long-term success of the brand. I think we're sitting on a gold mine. We're probably the car company that's closest to Ferrari. We're different from them and don't want to be them, but there are some strong similarities. And we know what the value of Ferrari is—it's recently been through an IPO.

■ ***Do you think you'll finish your career at Aston?***

☐ I hope so, but not the Aston I joined. I want it to be a phenomenally successful company, one that demonstrates that the cliché that you have to make 6 million cars a year to succeed in the auto industry is completely bollocks. That small can be beautiful.

■ ***What would you do differently?***

☐ I'd have bought a V-8 Vantage back when they were a quarter of what they cost now, and I'd make a few changes to my personal life, but from a career perspective, nothing. That said, I'd never recommend my kids do what I did, leave school at 16. Like any parent, I want them to go to college. But what I did just worked for me. ■

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- Kathryn W., Melbourne, FL

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